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C.F.A. Report

The ironfoundry industry will no doubt receive the Annual Report for 1951, of the Council of Ironfoundry Associations, with a measure of justifiable pride. It tells of last year's record production of castings which attained the creditable total of 3¼ million tons; of the sum of nearly £15,000,000 spent on modernization since 1946; of the high proportion of this amount devoted to amenities, and of the real help the Council has been to the British Cast Iron Research Association, the Institute of British Foundry, and to the educational activities of the industry. The attention given by the Council to working conditions and health is most praiseworthy. Industrial hazards are not static and it is good to note that, when new processes and materials are introduced, their effect is expressed immediately —for example, the introduction of pitch into foundry in increasing quantities is being continuously examined for deleterious effects. It is obvious from reading the Report that the industry has merited the remark made by the Chief Inspector of Factories which states that "There are grounds for satisfaction in the overall picture of improvements achieved so far in ironfoundry conditions."

The work done and the importance achieved by the Council during its short existence of ten years with a comparatively small staff is remarkable, and makes one wonder how the ironfoundry industry was represented before its formation. Whilst, admittedly, there was less Government interference with industry years ago, there were rules and regulations in force. If a foundry owner objected to some phase of application he wrote a letter to the Press. Nowadays, one gathers from the Report that dealings with the Government are almost a routine activity.

Though a slight increase in membership of the constituent bodies is shown, it is essential that added support be given, if the best results are to be obtained. The work thrown on the shoulders of the voluntary officials is indeed onerous, and every ironfounder should be grateful for time, trouble and expense incurred by this handful of busy workers. This 37-page report should be carefully studied by all founders—ferrous and non-ferrous alike—for it shows in the clearest possible way the real value of co-operative action on matters affecting the very existence of their businesses. It must be remembered that the strength of the C.F.A. rests entirely upon the constituent bodies and these are so widespread, geographically, and serve through so many trade interests that every ironfoundry owner is catered for. Yet there are still many concerns who, whilst receiving very considerable benefits, still remain unattached. We ask them to write to the Council at 14, Pall Mall, London, S.W.1, for a copy of the Report and see for themselves how their interests are being protected and advanced.

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Ardennes Hospitality Reciprocated

Between 40 and 50 founders from the Ardennes area of France have been paying a short visit to London as guests of the London branch of the Institute of British Foundrymen. A full programme of works visits in the London area was arranged for them. On Monday morning they visited K & L Steelfounders & Engineers, Limited, Letchworth, coming back to R. & A. Main, Limited, Edmonton, in the afternoon. The party divided on Tuesday, some going to Bagshawe & Company, Limited, Dunstable, in the morning, and Qualcast (Ealing Park), Limited, in the afternoon, and some to Langley Alloys, Limited, and the Western Foundries of Le Grand Sutcliffe & Gell, Limited, Southall, respectively. On Wednesday morning, the foundry at Ford Motor Works, Limited, Dagenham, was visited, and the party left for France in the afternoon. In addition to these, a number of special visits were arranged for small groups to go to J. Stone & Company (Charlton), Limited, W. H. Dorman, Limited, Stafford, and Spong & Company, Limited, Tottenham. The London branch arranged for interpreters to go with each visit, and everything went off very well.

The French party, including several wives, arrived on Saturday, May 3, and were met at Victoria Station by officials of the London branch. On Sunday, accompanied by some members of the branch and their wives, an excursion was arranged to Hampton Court, where the gardens were delightful, and then by river boat to Windsor. In spite of most unpleasant weather for parts of this trip, everyone appeared to enjoy themselves; the party returned to London by coach. On Monday evening the London branch gave a reception and dinner at Simpson's-in-the-Strand in honour of the visitors, with the president of the London branch, Mr. L. G. Beresford, in the Chair. The compliment was reciprocated by the visitors on the following night at a return function, when they presented the London branch with a mounted and engraved bronze art casting of a wild boar of the Ardennes, some 10 in. high, weighing about 40 lb. The Chairman's (Mr. Cury's) speech was replied to by Mr. D. G. Bisset, senior vice-president, in French, when he also stressed the gratitude of the London branch to the firms who had opened their doors and given hospitality to the French guests. Later in the proceedings, the president of the *Syndicat des Fondeurs sur Modèles des Ardennes*, Mr. Charles Cury, was presented with a casting of a frog, as were the secretary-treasurer, Mr. G. Guillet, and the secretary, Mr. A. Durbecq. These had been made by Mr. W. G. Mochrie, the branch secretary. This presentation was made by Mr. V. C. Faulkner, past president. Arrangements for the visit were made Mr. A. R. Parkes.

C.F.A. Information Officer

Mr. Basil H. Tripp has been appointed information and Press officer to the Council of Ironfoundry Associations. He will also undertake special duties in connection with the work of the Council's market-development committee and the development panel. Mr. Tripp is the author of "Grand Alliance," a short history of Allied Ironfounders, Limited, and of "Founded on Fact," a survey of the British ironfounding industry to-day. He has been a technical journalist for many years and has at different times held the editorships of several trade and technical journals associated with engineering and kindred industries. He was also for a long period the managing editor of a number of technical directories and reference books. His appointment marks an important extension in the work of the Council of Ironfoundry Associations and is the outcome of the steady growth of its influence in, and the services it renders to, the ironfounding industry.

International Foundry Congress

By Our Special Correspondent

Continuing the report of the delegation of British and Continental foundrymen to the International Foundry Congress and Exhibition in America (see last week's issue), the visit of the "Red" tour to Cleveland, Ohio, concluded with a visit to the Ford Motor Company's engine works near Cleveland. The large machine- and assembly-shops are now in operation and at an early date the foundry will be completed and working. At present, much of the machinery is in the course of erection, and the visit provided a unique opportunity to inspect the plant of a very large, highly-mechanized foundry during the installation stage. When completed, this foundry will be one of the largest and most highly-mechanized in the world.

Chicago, the second city of the United States, was reached on April 24 after an all-night journey from Cleveland. The foundries of Chicago and district range from large, highly-mechanized plants to small general jobbing foundries. The city also has several pattern-making establishments, some of which carry out repetition work of the highest accuracy and quality.

Several important steel foundries also are located here. Parties of members of all the nationalities included in the group visited most of these foundries. The "Blue" tour which has visited Buffalo and Detroit, arrived in Chicago on Saturday, April 26, and the two groups were together over the week-end. The "Blue" tour remains in Chicago for a few days, while the "Red" group passes to Cincinnati for an intensive two-day inspection of some of the well-known foundry plants in that city.

International Labour Organizations

Iron and Steel Committee

The Iron and Steel Committee, one of the Industrial Committees set up by the governing body of the International Labour Office to deal with conditions in certain major industries, opened its 4th Session in Geneva on May 5, 1952. The United Kingdom was represented at the meeting by the following delegation:—

Government representatives: Mr. J. G. Stewart, assistant secretary, Ministry of Labour and National Service, and Mr. T. Stanes, C.B.E., assistant secretary, Ministry of Supply.

Employers' representatives: Mr. R. Mather, member of the executive committee of the British Iron and Steel Federation; chairman of the council of the British Iron and Steel Research Association; president of the Iron and Steel Institute; chairman of the Skinningrove Iron Company, Limited, and Mr. J. G. Summers, C.B.E., D.L., director of John Summers and Sons Limited.

Workers' representatives: Mr. Lincoln Evans, C.B.E., member of the Trades Union Congress General Council; general secretary of the Iron and Steel Trades Confederation and Mr. J. Owen, member of the Trades Union Congress General Council; general secretary of the National Union of Blastfurnacemen, Ore Miners, Coke Workers and Kindred Trades.

A LITTLE MORE STEEL instead of a little more talk was asked for by Sir Charles Barlett, managing director of Vauxhall Motors, Limited, after the eastern region exports officer had addressed the Luton (Beds) Chamber of Commerce recently. Sir Charles said it was the big things like cars which counted in North American markets, and his company had to withdraw from Canada because it could not get steel.

British Industries Fair

Engineering and Hardware Exhibits at Castle Bromwich

Among the stands at this year's Castle Bromwich, Birmingham, section of the British Industries Fair are many which will attract attention from foundrymen. For the casual stroller along the miles of avenues—there are 1,300 exhibitors in this year's Castle Bromwich section alone—perhaps the major interest is in the gadgets and labour-saving devices of the general stands which so frequently provide germs of ideas for application to one's own work. Other visitors prefer to regiment their travels among the stands and for this group we append details of some which caught our representative's attention as having at least a modicum of foundry flavour :—

Auto Diesels, Limited (C.728, outdoor 1229) are exhibiting a selection of generating equipments taken from their standard range including a Leyland-Auto Diesels model, as supplied for stand-by purposes. Equipments not previously exhibited include a 1 kw. totally-enclosed unit, as supplied for fitting to excavators to provide power for floodlighting, and a 500 w., 230 v., a.c. portable equipment of extremely compact design.

British Thomson-Houston Company (C.511/410) have, as a central feature, a correctly scaled reproduction, over 16 ft. high and 14 ft. dia., of a 62,400-kva. vertical water-wheel alternator. This exhibit forms an appropriate background for the display of B.T.H. electric equipment for industry, ranging from switchgear to lamps and lighting for foundries. Among equipment for industrial materials heating, the largest unit is a cast-iron type of "Pyrobar" heater, 7 ft. 6 in. long and weighing 450 lb. for a hot-tinning bath.

B.T.R./Silvertown Group (D.615). On this stand are exhibited B.T.R. long-life conveyor belts that have played a large part in the mechanization of the modern foundry. Worthy of special mention among these is a heat-resisting belt used for carrying hot castings and hot sand as on knock-out conveyors. This belt is not only tough and long-lasting under the most punishing conditions of hot loads but is highly flexible for fast, short-centre conveyors, which may be, because of space considerations, on small-diameter drums. Also exhibited are shot-blast hoses (including anti-static-electricity hose) and anti-corrosive tank and pipe linings.

J. Brockhouse & Company, Limited, and Associated Companies (D.405/304). The Brockhouse organization includes among a wide range of finished products, grey-iron castings by J. Brockhouse & Company, Limited, and R. J. Hunt & Son, Limited; iron and steel castings by Brockhouse Castings, Limited; steel anvils and vices by John Brooks (Lye), Limited; acid-resisting castings by Meldrums, Limited; die-castings by Kaye Alloy Castings, Limited; and gas cookers and enamelled hollow-ware by Orme, Evans & Company, Limited.

Alfred Bullows & Sons, Limited (D.743/642). The main exhibit is the entirely new range of Hydrovane rotary compressors, which will interest all compressed-air users. This compressor has no valves, pistons, piston rings, connecting rod, or crankshaft, the only moving parts being a slotted Meehanite rotor and a number of alloy cast-iron vanes. A water-wash spray booth of 17 ft. 6 in. width (this ordered by a well-known aircraft company), an automatic traversing spray gun; and a range of other spray guns, pressure paint containers with air-operated agitators, air filters are also shown.

For the vitreous enamelling industry there is a range of guns with nozzle set-ups particularly applicable, together with pressure containers, designed for use with enamel, including a container with a special mounting for the air motor driving the agitator paddles, with an outrigger bearing the paddle shaft to avoid the wear under the highly-abrasive conditions. In addition, the L.4000 automatic traversing mechanism mentioned is widely used for application of vitreous enamel to flat work, such as cooker panels, etc.

Colt Ventilation, Limited (B.506) are exhibiting a range of heavy industrial ventilators, the purpose being to show how they work, the ease with which they are fitted, how a survey is carried out, and some of the interesting installations already operating. This is being achieved by means of working models, a continuous film, photographic sequences, and by having specialized technical staff on the stand to give explanations, where necessary. Arrangements can be made on the stand to survey the ventilation problems of the foundry of any interested enquirer.

Cuxson, Gerrard & Company, Limited (B.516). These suppliers of industrial first-aid requisites have equipped their stand as a typical works ambulance room, displaying dressings, ointments, plasters, penicillin preparations, first-aid outfits, and general ambulance-room equipment.

David Brown Companies (D.343/238). Several companies within the David Brown Gear Group are showing selections from their standard range of products, but of major interest to founders is an impressive centre-piece to the stand formed by a large fully-machined cast-steel tyre and trunnion made by David Brown-Jackson, Limited, for a cement-mill installation. Weighing 8½ tons, the tyre is approximately 12 ft. o.d., 10 ft. i.d., and 2 ft. wide; the trunnion is approximately 3 ft. 6 in. dia. Notable examples of current production of the David Brown Foundries Company are a half-turbine-case steel casting, weighing seven tons, for use in connection with a 60,000-kw. turbo-alternator, and a well-head casing with control heads, incorporating a number of high-pressure steel castings. Designed to withstand a test pressure of 10,000 lb. per sq. in., the unit is 7 ft. 3 in. high and weighs approximately 5,000 lb. Also included are a selection of castings in high-tensile and stainless steel, heat-resisting centrifugal castings, precision castings, and a variety of Taurus bronze castings.

Edgar Allen & Company, Limited (D.536) show a range of steel castings, small tools, permanent magnets, special tool steels, axlebox liners, etc. Shown for the first time is a 24-in. dia. circular saw, which has proved exceptionally successful in the sawing of magnesium and aluminium at Sterling Metals, Limited, Nuneaton. Working on magnesium, these saws cut about 160 castings a day, and their life is about 1,600 castings before regrinding is necessary. A saw runs for about 10 days between regrinds. The steelfoundry department exhibit includes some large roller supporting brackets in toughened cast steel, a nickel-chromium steel shipper shaft pinion with 13 teeth, 2-in. pitch, and another of the same type with 12 teeth, 2¼-in. pitch. As an example of complicated steelfoundry work a crawler truck frame will be shown, designed for a large excavator; smaller castings include chain sprockets for excavators and cast-steel slide clutches.

British Industries Fair, Castle Bromwich

Electromagnets, Limited (C.605) show a fully-enclosed version of the recently developed Boxmag super-intensity electromagnetic head unit built into a short band conveyor unit. Also exhibited are a high intensity, heavy-duty agitated chute separator, of the electromagnetic type, and prototypes of new permanent-magnetic separators, known as the "Unimajor," which can be built up to any reasonable width in multiples of 6 in.

Foundry Equipment, Limited (D.427/326). Exhibits here include a new "Major" sandrammer, together with a suitable vertical electric skip-hoist loader, and also the "Junior" sandrammer. Additionally, there is a new batch-type sand mill of revolutionary design, together with a new design of disintegrator or aerator which can be supplied in a fixed or portable form.

Foundry Equipment, Limited (D.427/326). Exhibits for bonding foundry moulding sands is the main exhibit here, and testing apparatus is available to demonstrate the material in various moulding sands, both silica and naturally bonded.

The Gas Council (D.641 and 540). Exhibits on this stand for founders include a natural-draught furnace, by Incandescent Heat Company, Limited; a portable cover furnace of the Dowson & Mason Gas Plant Company, Limited; a continuous vertical core-stove, by Foundry & Engineering Company (West Bromwich), Limited; a core-drying oven, made by F. J. Ballard & Company, Limited; an infra-red blacking dryer, by Thomas de la Rue & Company, Limited; a ladle dryer, by Thermic Equipment & Engineering Company, Limited; a mould-dryer, built by Modern Furnaces & Stoves, Limited, as well as mould-drying torches, of Selas Gas & Engineering Company, Limited, and the East Midlands Gas Board.

Keith Blackman, Limited (D.755/654) are showing a large number of fans and blowers suitable for foundry use, as well as the W.1100 model wet-type dust-exhausting and collecting unit; the "Tornado" unit heater; and the T.250, T.500 and T.1100 dust-exhausting and collecting units.

Morgan Crucible Company (D.305/204). As usual, this stand is particularly interesting to those founders who use crucibles and crucible furnaces, and the Company's new range of Suprex crucibles to withstand heavy-duty service are specially featured. Refractories, including "M.R.1," claimed to remain rigid at 1,600 deg. C.; refractory shapes; contact tips for switchgear and Morganite sintered metal for clutch facings and the like are also given prominence in the display.

B.O. Morris, Limited (D.423). Exhibits include a representative range of Morrisflex flexible shaft machines, handpieces and accessories; polishing lathes and motorized backstand idlers. "Erma" automatic polishing machines (for which the firm are sole agents in U.K. and Australia), are on show at the B.I.F. for the first time, as are the twin-head brushing machines, model M.151/4P and M.151/14P. Additional lines include Morrisflex industrial wire and fibre brushes, rotary files, cutters rasps and mounted points, polishing mops, materials and compounds.

Newton Victor, Limited (C.709). X-ray equipment for industrial purposes is on show on this stand, the chief interest being centred on practical working demonstrations of fluoroscopic examination with the "Raymax 140" unit. This equipment is designed for continuous operation from 30 to 140 kvp and is capable of producing first-class radiographs of steel sections up to 1¼ in. thickness. It is particularly suitable for radiography of light alloys castings., and combines a high degree of flexibility with accurate yet simple control facilities. In addition to the fixed type, a completely self-contained mobile model is shown for the first time.

Radiation, Limited (B.501/400). A really beautiful display of vitreous enamelled solid-fuel cookers and ranges, inset and freestanding stoves, convector fires and grates, inset grates, coke heaters, and a glass-panelled unit demonstrating the firm's whole-house warming system on this stand is typical of quite a number on which this vitreous finish on cast iron is shown in wonderful variety. Four new models—Yorkvale, Yorkist, Raymax Mark II and Cheston—are shown for the first time.

Rapid Magnetic Machines, Limited (C.421) are exhibiting a wide range of products, the end use of which is separation, transmission or magnetic transportation. This year's show has special emphasis on the firm's entirely new range of permanent magnetic chutes and plate-type separators. This equipment, incorporating Alnico or Alcomax permanent magnets, has been designed to meet all the requirements of separating tramp iron from wet or dry sand in foundries. Electro-magnetic separators for treating many different materials, including two for swarf separation, which will be shown in operation; electro-magnetic clutches and brakes for power transmission; lifting magnets and feebly-magnetic ore separators will also be included.

Riley Stoker Company, Limited (D617/516). This Company, as well as showing automatic drying-stove stokers, has a demonstration of Syntron electric vibrating and feeding equipment. On this model, sand from an FM-01-25 feeder machine is fed into an F2 feeder which discharges it into an FO-1 feeder. The FO-1 feeder discharges the sand into the bowl of a spiral feeder, which conveys it up the spiral back to the hopper of the feeder machine, thus completing the circuit. The spiral feeder, which is being exhibited for the first time, raises the sand to a height of 4½ ft. Other Syntron equipment displayed includes a range of electro-magnetic vibrators for attaching to foundry sand hoppers, bins and chutes, or wherever materials tend to clog.

Stewarts and Lloyds, Limited (D.511/408, B.404, and D, outdoor). On the principal stand of this Group (outdoor) is included oil country tubular goods, including welding fittings; coal-mining equipment; foundry and basic pig-irons; and various iron and steel castings; including the products of their associate Company, Ernest N. Wright, Limited, specialists in blast-furnace steelwork, iron castings and structural engineering, and John Russell & Company, Limited, who are exhibiting gunmetal valves and fittings for steam, water and gas, radiator valves, pipe fittings, hose connections, and chromium-plated taps and fittings.

Wolf Electric Tools, Limited (C.603). Many portable electric tools of interest to founders and pattern-makers are shown and demonstrated on this stand, including drills, from the ¼ in., type EG2c, up to the 1¼ in., type NW10 models; electric screwdrivers, portable grinders bench and pedestal, polishers, sanders, blowers, chisel mortiser, hammer kits, and a powerful 10-in. portable, ball-bearing electric saw.

* * * * *

The Fair will be open at 9.30 a.m. each day (excluding Sunday, May 11) until 6 p.m., except on the final day, Friday, May 16, when it will close at 4 p.m. For the convenience of buyers, admission to the general public is restricted until after 2 p.m. daily, though there are numerous works party visits from the large industrial centres.

Production of Castings in Aluminium-bronze, D.T.D.412*

By L. Hargreaves

The D.T.D.412 specification for aluminium-bronze sand castings, states that test-bars either cast-on or separately cast, shall have a tensile strength of not less than 40 tons per sq. in. with a minimum elongation of 12 per cent. on 2 in. Also specified is the chemical composition of the castings which must fall within the following percentage limits:—

Aluminium 8.0 to 12.0; nickel 3.0 to 6.0; iron 3.0 to 6.0; lead not more than 0.05; tin not more than 0.20; zinc not more than 0.50; silicon not more than 0.25; magnesium not more than 0.10; manganese at maker's option up to 2.5 and copper the remainder.

As will be readily appreciated, the continued production of test-bars to these very stringent requirements and castings to the composition specified, particularly with regard to impurities, calls for a large measure of technical control and supervision. At the same time, the short freezing range of this alloy and the tendency to form tough films of oxide on the surface of the molten metal, make it a difficult material to handle in the foundry, and a high degree of skill is called for from the moulder if castings are to be made free from shrinkage, draws, oxide inclusions, cold laps and other defects. The fact that completely sound castings and test-bars with up to 45 tons per sq. in. tensile with 18 per cent. elongation are being regularly produced, is due in some respect to the amount of co-operation which exists in this non-ferrous foundry between the craftsman and technician.

Initial Experiments

Before the actual production of castings was commenced, experiments were instituted to see if test-bars could be made which would fulfil requirements. A quantity of D.T.D.412 ingots was brought in and various test-bars were cast in green- and dry-sand. These were all of the D.T.D. wedge type, with a bottom run through and a horn-type gate. These early attempts met with failure and it was decided to modify the composition of the material, increasing the aluminium content by 1 per cent. to bring it to 11 per cent. Although the new test-bars were better and gave tensile strengths only two tons short of requirements, the aluminium addition had reduced the elongation to only 8 per cent. It was thought that manganese would increase the tensile strength without having an adverse effect upon the ductility, and consequently some test-bars were prepared in which the manganese content was raised from 0.5 to 1.5 per cent., the aluminium remaining at 11 per cent. With this modification, the desired results were obtained, an average of six test-bars giving 42 tons per sq. in. with 13 per cent. elongation. It was originally intended that test-bars should be cast on the actual jobs, but in view of the complicated feeding and running methods required it was decided upon consultation with the inspector to cast the test-bars separately, and at the same time it was decided to chill the bars by casting into a cast-iron chill which was incorporated in the mould.

This practice as had been anticipated gave even higher tensile strengths, but, what was more surprising, increased the elongation at the same time. Before leaving the subject of test-bars it may be of interest to say that the aluminium-bronze was found to be very notch-sensitive. In many cases, the test-bars broke at the elongation pop marks if these were unduly large, or at the radius if this was not turned perfectly without any unevenness. A perfect finish is needed on these bars and the two-inch gauge length must be very lightly marked.

Melting and Pouring

The following technique has now been adopted as standard practice for this alloy. The required amount of manganese/copper together with about six ingots of D.T.D. 412 and the recommended amount of a proprietary flux, are charged into the crucible which is either fired in a pit-type natural-draught coke furnace or in an oil-fired tilting furnace according to the quantity of metal being melted. When molten, foundry scrap not exceeding 25 per cent. of the total charge and the rest of the ingots are added, and when these are melted a further quantity of flux is placed on the surface of the melt. The metal is now superheated to about 1,200 deg. C. and the aluminium is then added carefully, after which the metal is transferred to the pouring ladle. A further quantity of

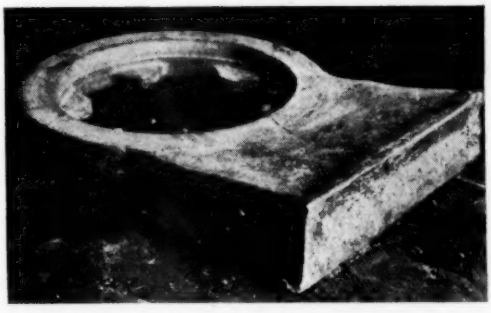


FIG. 1.—*Casting for a Gear-wheel Blank, with a Heavy-type Feeding Head.*

* A winning entry in a Short Paper Competition organized by the Newcastle and District branch of the Institute of British Foundrymen.

flux is added and well stirred in. The resultant slag is thickened with dry sand and skimmed off, the metal being allowed to cool to the correct temperature before pouring. The casting temperature ranges from 1,160 to 1,220 deg. C., the higher temperatures being used for small thin-sectioned castings. An interesting point is that if a casting be of large area a high casting temperature may have to be used even though the casting is of a large section, as the first metal flowing over the surface of the mould may become chilled and coated with oxide before the rest of the metal enters the mould, causing a cold shut. With some large castings, such as gear rims and wheels which may be 5 ft. in diameter, a temperature of 1,270 deg. C. has been used with complete success, although a temperature of 1,160 deg. C. would have been high enough to run the job.

When first castings were made in aluminium-bronze, it was sometimes necessary to pour a large number of small green-sand castings. These were arranged in a long row and casting was commenced at 1,200 deg. C. from a large crucible. This high temperature was used to allow for the large number of boxes which had to be poured. It was found that although the last few castings were generally satisfactory, the first, which had received the hottest metal, often suffered from severe shrinkage. This method of casting has now been discontinued and if a large number of small castings are to be poured, the metal is superheated to about 1,200 deg. C. and transferred to a small hand-shank a little at a time where it is allowed to cool to 1,160 deg. C. before casting a small number of jobs. This method takes much longer, but it has been found to be more economical in the long run due to the better castings produced. In pouring, the usual precautions are taken of keeping the oxide film skimmed back and the pouring basin full.

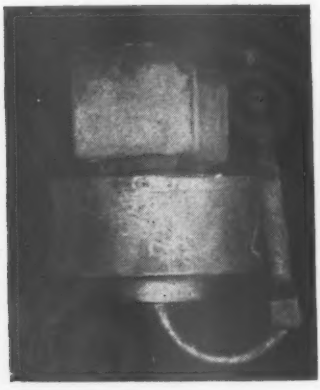
Moulding

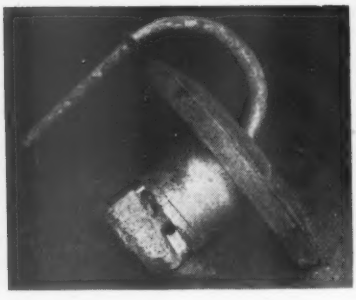
The normal sand employed for other non-ferrous work is used for aluminium-bronze. This has a basis of Yorkshire yellow sand to which additions of Northallerton red are made to maintain bulk. The green-sand is milled regularly in batches and an addition of 0.5 per cent. bentonite is made, the moisture content being controlled at 8.5 per cent. The main differences in moulding aluminium-bronze castings are the gating arrangements, the provision of adequate feeding heads to combat the severe shrinkage, and the use of chills to promote progressive solidification.

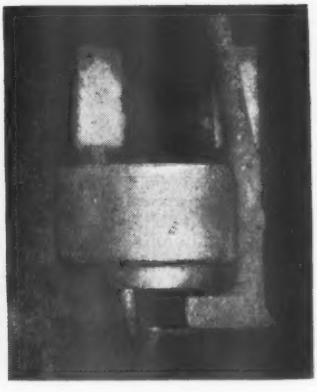
Gating.—It has been found that the only really satisfactory method of gating is by means of a reverse horn-gate, that is, the horn is narrowest at the down-runner end and widest at the casting. This ensures a steady flow of metal free from spurting or turbulence. The gate should be kept as small as possible consistent with being able to run the casting, not only to keep back dross but, more important, to prevent inverse feeding which has been found to occur with some castings if the area of the gates be too large. In this case the difference in temperature at the end of a pour between casting and gate causes the gate to take metal from the casting resulting in shrinkage cavities which are sometimes revealed only after expensive machining operations. The horn-gate patterns used are conveniently made from lead and can be bent to any curvature necessitated by the position of the pattern in the moulding box. Multiple gates are sometimes needed on large castings and these are arranged to receive metal from a common down-runner. A plug is used over the runner for large castings, the plug being drawn when the basin is full.

Feeding

The use of riser sleeves made from an exothermic or heat-generating compound, greatly facilitates the feeding of difficult castings and reduces the size of feeding head required. A head if of the normal type may have to be inordinately large to feed an aluminium-bronze casting. Fig. 1 gives some idea of the size of such a head. This was an early attempt to produce a gear wheel blank. Even with so large a head, shrinkage was present when the head was removed, although it was not excessive and the casting was used with success.







FIGS. 2, 3 and 4.—*Typical Castings in Aluminium-bronze, D.T.D. 412. Note the Feeding Heads and Reverse Horn-gates.*

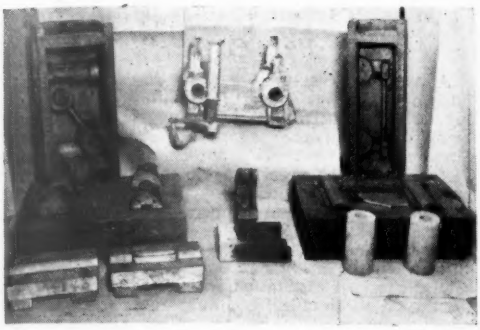


FIG. 5.—*Coreboxes and Cores for a Bracket Casting in D.T.D. 412. Exothermic Sleeves used to feed the Bosses are shown in the Foreground.*

The use of exothermic feeders is the greatest single factor contributing to success in founding D.T.D.412. The sleeves are made in a corebox with the feeding compound suitably tempered with water. The sleeve is in the form of a hollow box, the top being open and the bottom closed except for a small slot. This small neck being surrounded by a relatively large source of heat, remains fluid and allows the metal to run into the casting. At the same time the heads may be readily removed during fettling. Provision is made on the pattern for these feeding sleeves, generally in the form of loose-pieces, which are placed over the bosses etc. on the pattern. These are rammed up in the top-part of the mould and the feeding sleeves are inserted in the cavities so formed when the mould is finally closed. The sleeves are rubbed down to an easy fit and grooves are cut in the sides to help venting and to augment the vents made by the coremaker.

Chills

On castings of uneven section, chills are a great help, especially on heavy sections which are cast down and cannot be directly fed from the feeders. These heavy sections solidify last and in feeding the thin sections are often left unsound. The chills should be dry and preferably warmed before being placed in the mould and casting should take place within a short time to avoid the "striking back" of dampness if the moulds stand for a long time. This is a particular danger if the moulds are made in green-sand, and a bad practice is to peer into the mould during pouring when it is known to contain chills. If the chills are on a machined face as is often the case, a generous machining allowance should be given as oxide often adheres to the chill faces and needs several machining cuts for removal.

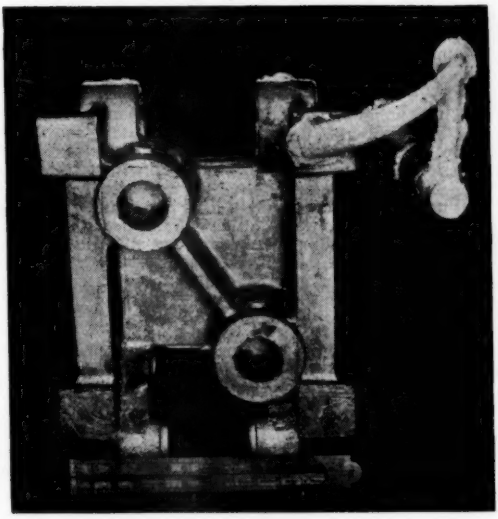


FIG. 6.—*Finished Bracket Casting. Note the Fine Surface Appearance.*

Figs. 2, 3 and 4 show typical castings in D.T.D.412 Of particular interest are the reverse horn-gates and feeding-heads. Fig. 5 shows the coreboxes and cores for a bracket casting. In the foreground are the exothermic sleeves which are used to feed the bosses on the casting. Fig. 6 is a close-up of the job; the good surface finish is typical of an aluminium-bronze casting.

In conclusion, if this Paper has given any help at all to anyone engaged on or contemplating the making of castings in D.T.D.412, the effort will have been well worthwhile as it is felt that only by discussing mutual difficulties and experiences, can the full potentialities of this very useful alloy be utilized.

The Author thanks all who have helped in any way and particularly the directors of Clarke, Chapman & Company, Limited, for permission to present this Paper.

Research at Royal Technical College, Glasgow

A report on research in all departments of the Royal Technical College, Glasgow, for the 1950-51 session has just been issued. This volume provides a brief record of the work in progress together with a list of the more important publications and the titles of theses approved for higher degrees. It replaces the former Journal of the Royal Technical College, publication of which has now ceased. Among investigations carried out by the Department of Metallurgy are slag/metal relationships, iron-ore sinter, powdered metals and "wettability" of coke by slags.

Engineering Courses

MISS HORSBRUGH, Minister of Education, said that the engineering courses provided in technical colleges were being continuously reviewed and developed, but in general she considered that the present system of craft courses leading to the examinations of the City and Guilds of London Institute and the courses leading to national certificates was meeting the requirements of the engineering industry. The Minister said that a proposal for a national craft apprenticeship certificate for the engineering trades was considered and rejected by the National Advisory Council.

Publications Received

Manual Lifting and Handling. Issued by the Industrial Welfare Society, Inc., 48, Bryanston Square, London, W.1. Price 2s.

This pamphlet relates to a subject upon which little has been written in a form suitable for use in the workshop. During an apprenticeship, a neophyte is usually given instruction on how to handle various components, including heavy weights. A matter mentioned but not given sufficient emphasis is the need for keeping the feet close together when lifting heavy weights, and thereby avoiding the risk of hernia. This booklet should be in the possession of all welfare officers, sports masters, foremen and all others in charge of the training of youth, for it is at this stage that good habits can be inculcated.

Annual Report, 1951. Published by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

As would be expected, the Report opens with comment on the Iron and Steel Act, 1949, which transferred most of the industry into a State monopoly. This happily is to be changed in the near future. The section on raw materials comments on the steel scrap drive, which has undoubtedly benefited the foundry industry. It is stated to have been somewhat disappointing, but realizing that large quantities still exist, the drive is being intensified this year. The Report comments that the quality of coke is far from satisfactory. It makes very interesting reading, much of which is germane to the foundry industry.

Job Grading. Published by the Office Management Association, 8, Hill Street, London, W.1. Price 10s. 6d.

For the average business, there is much sentiment in the allocation of staff positions and even in the selection of personnel. There is a good deal of truth in the story of the Admiral, who after interviewing a large number of W.R.N.S. applicants for the position of secretary, decided to select the "good-looking blonde." If insistence on grading of clerical work, the method of grading and merit rating be deemed essential in a large concern, then this book could be of substantial help to a director or secretary when building up the office personnel of a new firm or in a major re-organization of an existing business.

Computation of Trading Profits for Taxation Purposes. Published by the Federation of British Industries, 21, Tothill Street, London, S.W.1.

Properly to appreciate this pamphlet the reader should also possess a copy of the Report of the Millard Tucker Committee bearing the same title. The reviewer had not this advantage but still found it quite interesting. The overall impression received is that the system of income tax, like insurance, assumes that currency is stable, whereas it is anything but. Just one quotation emphasizes this:—"Stocks valued at £20,000 to-day may be physically equal to stocks valued at £10,000 a few years ago, even though the whole difference (£10,000) has been charged to tax as a profit. This difference is not a true profit in the sense of being available either for distribution or to be paid in taxes."

THE MINISTER OF FUEL AND POWER stated that he hopes to publish details of the Government's scheme to make available a sum of £1,000,000 for loans to firms to facilitate the installation of approved fuel-saving equipment, before the end of next month.

Wasters Caused by Ramming

By "Coroner"

A particular casting of a colliery winding-drum, the body of which was about 2 ft. 6 in. dia., was being cast regularly without trouble in a foundry and, the order being completed, the pattern was returned to stores. Some considerable while after, on commencing manufacture to a fresh order, trouble was experienced from gassy patches on top of the flanges and it was at first thought that the metal temperature was at fault, as on a former occasion similar trouble had been experienced, due to gas being trapped from the lightening core, when the metal temperature was too low. A careful check of casting temperature revealed that there should be no trouble from this cause, as it was well above the predetermined minimum for this job and thus the fault had to be sought elsewhere.

It was then recalled that this was the first batch of this type of casting to have been produced since the introduction of a pneumatic rammer and it was questioned whether the moulder had rammed the middle part of the mould excessively hard and thus prevented the escape of gas from the mould. Following this line of approach, it was established that hard-ramming was the cause of the trouble, for not only had the moulder used the new pneumatic rammer which had consolidated the sand more but he had also omitted a course of cinders from over the top of the flange, which was previously used to avoid gas trouble. Reverting to softer ramming and re-introducing the cinder layer eliminated wasters from the cause mentioned.

Chamotte Cores*

The following information refers to chamotte cores, the use of which is quite normal in steelfounding, because of the high degree of refractoriness they possess. When making moulds on which a superficial metal penetration is permissible, the following mixture can be used:—

Large-grained chamotte ...	100	parts by weight
Refractory clay	12	,, ,,
Graphite	1	,, ,,
Water	8	,, ,,

The chamotte in question will have a grain-size, according to the A.F.S. fineness index, of the order of 50 and will carry grains up to 3 to 4 mm. If it be desired to make a core capable of resisting all metal penetration, then the following mixture is to be preferred:—

Fine-grained chamotte ...	100	parts by weight
Refractory clay ...	20 to 22	,, ,,
Graphite	1	,, ,,
Water	15	,, ,,

In this instance, it is good practice to use a chamotte much finer than in the former case; its A.F.S. fineness index will be about 80 to 100, and it will have no grains bigger than 0.5 mm. dia. Attention is drawn to the fact that this mixture only seems capable of giving good results with cores of simple shape.

In fact, as there is a high proportion of clay, and thereby a naturally high moisture content, such cores are prone to cracking during drying. A wise precaution to take is to allow the cores to air-dry for some time before stoving, and during the latter operation to increase the temperature quite slowly—something of the order of 70 to 80 deg. C. per hr. The durability of chamotte cores *vis à vis* the metal is assisted by the application of a refractory coating based on silica, or better still, zirconium.

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* Translated from the February, 1952, edition of *Fonderie*.

Symposium on Investment Casting

The meeting began with the exhibition of two films, after which leading exponents of the investment casting process in this country amplified the operations shown by adding details from their own experience. Thereafter, in the open discussion, a wide range of aspects of the process were brought up, including general engineering application; casting of milling cutters and their superiority; the importance of prior planning; scrap and yield percentages; dimensional accuracy, die production and alternatives; application to various metals; mould permeability and the various requirements for mass-production.

A general meeting of the London branch of the Institute of British Foundrymen was held at the Waldorf Hotel, Aldwych, London, W.C.2, on Wednesday, February 27, 1952, at 7.30 p.m. The chair was taken by Mr. L. G. Beresford, branch president.

Opening the proceedings, the chairman said that the meeting would begin with the showing of two films on investment casting. After the films, the discussion on the subject would be opened by Mr. G. A. Tomkinson, of D. Napier & Son, Limited, who had had a wealth of experience in this type of casting, and, moreover, controlled one of the finest foundries in the country devoted to that process. The first film was an American one, showing operations on a production scale and exhibited by courtesy of Allis-Chalmers. The second film, which was sponsored by Mr. Frank Hudson, of the Mond Nickel Company, Limited, dealt with the process on the laboratory scale. Mr. Hudson would support Mr. Tomkinson in the discussion, and lively comment was expected because there was in the audience a number of people who were experts in the process. He particularly welcomed to the meeting Mr. Paget, of de Havilland Aircraft Company, and Mr. Brown, of the Lost Wax Company, of Croydon.

MR. TOMKINSON, opening the discussion, said the secrets of investment casting were at last laid bare by the films they had seen. They depicted Mr. Hudson's methods of laboratory manufacture of castings and the Allis-Chalmers' production methods, and were, he thought, pretty well covered. He had been glad to see the audience had not been told that it was possible to cast to within a thousandth part of an inch. It was high time that investment casters told the general users of their castings that it was impossible in most cases to cast to the very fine limits that most seemed to expect from that method of casting. His Company had produced castings to within a thousandth of an inch, but those castings had lent themselves to the particular casting method. The general line of castings could be produced to within ± 0.005 in. per inch of casting, depending on the alloy in which the component was cast. The film had not shown any technical details. He would point out that the accuracy which could be had by investment casting was entirely in the hands of the chemist and foundryman. The chemist made the investment which contained the binder to keep the refractory together. It affected the dimensional aspect and certainly the metallurgical side.

Foundryman's Role

To obtain accuracy and good castings, the foundryman had to enter the picture to show where the gates or runners should be placed. Some years ago, in the presence of Mr. Hudson, a very eminent metallurgist had said to him "For the Lord's sake, Tomkinson, keep the foundryman out of this game, or it will be destroyed." He would like to prove how wrong that man was today. Investment was essentially the foundryman's "game" coupled with the services of a good chemist. The secrets of good investment casting were bound up with the "know-how" of modern die production. If there were good dies, good wax patterns would follow. Then entered the chemist, to show how to mix the investment. It played an important part, for dimensions could vary widely according to the type of investment used and the particle or grain size of its various components. Although it appeared from the film that, having made a wax pattern and surrounded it by an investment, good castings and dimensionally-accurate castings would follow automatically, that was not the case. Accurate mixing of the investment, obviously, was bound to affect the dimensions inasmuch as there were three changes of state during the firing cycle of the particles of all the various investments used. So, although the many secrets in investment casting seemed to have been laid bare, the reason investment castings were excellent was based on very careful and precise control. He deplored the use of the term "precision investment casting." Makers of castings produced them for the engineer, and the engineer thought in terms of one ten thousandth of an inch as constituting precision, but castings could not be produced to such close tolerances. The basic physical laws which governed the solidification of metals would not allow such accuracy, even in the best-controlled investment mould.

Prospects

He could not go into highly technical details, because his Company were working under the licence of an American concern and were not allowed to divulge the intimate technical details of their methods, but he would say that investment casting had come to stay. In the next few years he expected to see many foundries set up in this country to produce as castings many jobs which previously would have had to be fabricated—with a reduced dimensional accuracy.

Alloys which could be used now were legion.

Symposium on Investment Casting

Not more than two years ago it was very difficult to cast carbon steels. He thought they had more or less overcome that difficulty and could now cast any metal that was castable, but carbon steels still remained quite costly as investment castings. There were in existence to-day many research programmes aimed at bringing down costs by providing stable investments, so that not so much money had to be spent on controlling investments.

His firm had been able to manufacture components which were normally only attempted by tool-room craftsmen, and other components which had to be fabricated by welding from a number of parts. Such items were now possible in one piece and the substantial amount of money which was formerly expended in fitting parts together could be saved. Investment casters still had a long way to go; much more development was needed as well as much more research before they could turn to the public and say they could make castings cheaply.

Gas-turbine Parts

MR. FRANK HUDSON remarked that most of the work done so far, both in the United States and this country, in connection with the production of castings by investment moulding methods had been mainly due to the development of the gas-turbine. The process largely came into being during the last war in connection with the production of aircraft-engine supercharger parts. After the war was over, many firms who had taken up the production of these castings became short of work and turned their attention to the possible usefulness of such castings in the field of general engineering.

To him that seemed a very healthy sign and Mr. Tomkinson, himself, and many others in this country, had during the past five or six years been trying to interest the general engineer in the possible use of castings made by investment moulding methods. They had many advantages, which, however, had been outlined many times before. With the advent of another vast armament programme, the possibilities of the adoption of precision investment castings to general engineering had taken, for the time being, second place. Firms who a few years ago were seeking far and wide for castings to make by this process were now finding orders coming back for armament requirement—mainly, again, from the gas-turbine field. Nevertheless, he hoped they would not lose sight of the value of this type of casting in engineering.

General Engineering Applications

On the present occasion, he did not propose to attempt to describe production methods. The films shown earlier had given a good idea of how the job was done. His theme was to make a plea, if possible, for the usefulness of precision castings made by investment moulding methods in the general-engineering field. In this connection, there were certain points worthy of mention. First there was the use in this country and in the United States (and perhaps Mr. Tomkinson would give members some further information) of the process for the production of tools, particularly milling cutters. Much work had been done in America and, in 1949, much data were published[1] of tests made in an engineering shop to compare the performance of cutters made by normal methods and those produced as castings similar to those which were seen in the film. The cutters were of average size, 3 in. dia. and $\frac{5}{16}$ in. wide, and the results of the machining tests clearly indicated that the performance of the cast cutters was superior to that of forged cutters. The new cutters were tried at various speeds and feeds. To give an example, with a depth of cut of $\frac{1}{4}$ in., a feed of 1 in., and a length of cut of 14 in., the total length cut by a cast cutter varied from 63 to 73.7 ft. before re-sharpening was required. With the ordinary forged cutter, taken from stock, the total length of cut was only 49 ft. That showed a marked improvement so far as the cast cutters were concerned and, throughout the whole range of tests, in every case the cast cutters showed up better than the standard forged article. It would seem, therefore, that for the production of milling cutters and tools of similar type, the investment process had a most promising future.

Cast Dies

A second application was the possible production of cast dies by investment methods—dies for die-casting, stampings, hot-pressings, etc. At the moment, the production of dies entailed a large amount of labour in die-sinking operations. If the investment process was developed, in the way it should be developed, dies could be produced requiring a minimum amount of machining operations and that would undoubtedly reduce cost and increase production.

Some time ago, he had given a paper to the Institution of Production Engineers in which he had shown examples supplied through the courtesy of Rolls-Royce, Limited, of investment castings actually used in the Rolls-Royce car, such as locks and lock mechanisms in austenitic stainless steel, water-pump impellers, etc. However, when one compared the use of such articles with what had been, and what was likely to go into the aeronautical field, there was really no basis for comparison. Nevertheless he did feel that the real value of the process lay with general engineering, and, if it was to stay, there would have to be found uses for it in that field.

Percentage of Defectives

His final point was in connection with the high percentage of defective castings produced by the investment process, especially when castings were being used for aeronautical requirements. When one had to produce castings for a highly-stressed structure like an aeroplane it was necessary for them to be 100 per cent. sound and one could not do this without a large number of rejects. Some years ago he had made a statement, which was never disputed, that a possible yield of 30 per cent.

[1] J. H. Penrose and C. T. Amond "Precision Cast Milling Cutters could solve a Crisis," *Machinist*, 1949, v. 93, No. 28. p. 989.

was about all one could expect when producing castings by investment methods for aeronautical requirements and that, of course, was another factor which increased cost. The yield of commercially-sound castings might be improved considerably if the process was applied to general engineering. They would not have to meet the onerous inspection methods associated with aircraft requirements and that in itself would automatically result in a higher yield of castings and was another reason why precision casings made by investment moulding methods should be applied to the engineering field, even if it was only to put them on a proper cost basis.

Cast Milling Cutters

MR. TOMKINSON said Mr. Hudson had referred to cast milling cutters and the amount of work that had been done on them in the States and had cited some remarkable performances. His own firm had made drills, reamers and milling end-cutters of all sizes and had been very successful. They had been approached by one of the leading cutting-tool manufacturers and stockists in this country to produce for them, with a provision, of course, that they should finish grind the cutting edges. However, his Company were not prepared to put down the necessary grinding machinery and they were now only producing for their own requirements. He thought Mr. Beer could state some of the remarkable achievements that had been obtained from some of those cutting tools.

Mr. D. O. Beer agreed with the figures given by Mr. Hudson, in fact, similar results had been obtained by the Company he was connected with. A figure of 30 per cent. increase in life over a forged cutter was a fair average. With regard to cutter shape, a rather more sturdy tooth design was advantageous and final finishing by normal cutter-grinding methods, similar to those for a forged cutter, was recommended. As to the economics of casting milling cutters, it must be appreciated that the cost of the pattern die must be absorbed within the number of cutters cast. Therefore, the batch must be large enough to cover this cost. Experience has shown that this could be done with batches from 36 to 48 castings. Below this figure, a manufactured cutter, either forged or machined and heat-treated from bar material, would be cheaper.

MR. TOMKINSON said the cost of the cast cutter, finished, was 49 per cent. of that of the forged cutter. He would mention that for cast cutters an 18 to 22 per cent tungsten material had been used.

On the second of Mr. Hudson's queries—the production of dies for die-casting—he thought eventually they would get down to that sort of thing. Most of the investment foundries in this country were primarily for the production of blades for jet or gas-turbine planes. Dies had been produced which required to be very accurately formed in materials which were unmachinable. Initially, the cost was high, but he thought they would be able to meet the requirements of the die-castings founders.

In his Company there was quite a large amount of commercial work. He had in mind a component which was imported to this country from America. It was a sewing-machine part and sold here for something like 30s. Restrictions had been placed on the import of those components and sewing-machine manufacturers approached his firm to see if they could cast them. They had to be cast to close limits of within 0.0005 thousandths of an inch. His firm had attempted the job and to their great delight found they were able to produce castings for the machine not acquiring any machining at all and they ran perfectly, giving 43,000 stitches a minute. They had sold 43,000 of those castings and had earned dollars by selling the castings in the States although American production was now catching up.

Similarly, his firm were now entering the field of cloth-cutter manufacture and had sold a few to the people concerned, but he was afraid they were going to lose that market eventually because the customer had told him that he had been sending their sets of castings to the United States to show how they should be made. However, as Mr. Hudson had remarked, there was a wide field, and provided people did not demand that a casting should fall within tolerances of one- or two-thousandths of an inch. Such limits could be achieved, they could cast almost to a dead fine limit on some faces, and provided they did not ask for all faces to be cast to such a fine accuracy, he thought eventually they would be able to meet the demands in most materials.

Important Factors

MR. G. W. PAGET (de Havilland Engine Company Limited) had found the films interesting and had greatly enjoyed hearing Mr. Tomkinson and Mr. Hudson. The first film had interested him the most because in 1946 he had had the privilege of spending two months in the Allis-Chalmers plant and he had recognized not only the work they were doing, but a few of the faces shown in the film.

Mr. Tomkinson had said, quite rightly, that one of the important men in this industry was the refractory chemist. He was important because his work controlled the tolerances of the castings just as closely as the tool-maker who made the dies. With regard to those fine tolerances he thought founders would have to shout down the designers. There was a case in his Company where they were trying to make a component to + 0.005 in. tolerance. In their hurry to get those castings on the first engine, they cut off the gate, but before they could finish the trimming, the progress man whipped them off and put them on the engine with ¼-in. of gate sticking out of the side! Fortunately it did not require accuracy to five-thousandths on that dimension.

An investment casting had to start on the design board. It was no good asking the investment founder to make a job as a casting just because the buyer had forgotten to order forgings. That had happened in many instances. Anyone who wanted investment castings should get hold of the designer and ask him to design for them. They could have parts designed for casting which would normally be machined from the solid, and the investment founder could cast them and give the properties

required. Mr. Paget's Company were now casting low-alloy steels with a tensile strength of 75 to 82 tons per sq. in. quite easily. Within the last three years they had got over the difficulties of casting carbon and low-alloy steels.

Investment Material

Mr. Tomkinson had also said that a change in investment could make much difference to the casting. In America, foundries could get investment material week after week and month after month without any variation in particle size. He wished that were the case in this country. Manufacturers of these materials were co-operating but they had a long way to go to make the process as cheap as it was in the States, because there, there was an adequate supply of accurate investments. Given the same here the makers could cut costs considerably.

If designers wanted really-close tolerances, the best thing was to cast to within 5- or 10-thousandths and then follow on with a grinding operation. Investment casting had never been designed to cut out the machine-shop. It was designed to cut out the 50 or so operations necessary to make complicated components from bar or forgings and in the film a job had been shown where they had cut out from 80 to 100 operations. In his Company there had been a case where they had cut 19 machining operations down to two; that was the ideal in investment casting.

His firm had to machine certain alloys which Mr. Hudson's Company produced, and they were not easily-machined alloys, but they could do six times the work with cast cutters that they could with wrought cutters. If anyone was interested in cast cutters, there was a company in Birmingham who were now, he believed, putting cast cutters on the market.

Yield

With regard to scrap, Mr. Hudson had said that he expected but 30 per cent. yield. On the other hand, Mr. Paget said he would not expect 30 per cent. scrap. If he had 15 per cent. scrap he would begin to look round to see what was the matter. Ten per cent. scrap was normal, and 5 per cent. should be the ideal, and this could be achieved. He had been working for a long time now on reducing scrap so he hoped the audience would not get the idea that investment foundries were making too high a percentage of scrap. The application of investment casting to industry came into this country only about 10 years ago. The process was still having its teething troubles and was still in the development stage, but as the first speaker had said, investment casting had come to stay; not to supplant other industries, but to supplement them.

MR. TOMKINSON answering Mr. Paget's argument about scrap percentages, thought that scrap, on a component ideally designed for investment casting, could and should be as low as 5 per cent., yet on components which Mr. Hudson had earlier remarked had to be 100 per cent. sound, he could not agree entirely with Mr. Paget. Crack-detecting, shock-testing, X-ray examination, surface examination, and other tests of a highly-stressed component revealed much more than 5 or 10 per cent. of scrap. His Company were making thousands of blades a week in very difficult alloy and scrap fluctuated between 5 and 22 per cent. With that very difficult component of a highly-stressed nature, every precaution had to be taken to see that engines were fitted with the finest possible blades and he was afraid that scrap on those components could be high. Acquaintances who had just returned from America had informed him that the scrap on some of the components manufactured in America was as high as 90 per cent., and on simple components, as low as 10 per cent.

MR. LISTER supported the remarks on scrap percentages in the States. They were rather higher than he would have expected, but much was due to faulty investment and inclusions—all problems which concerned the foundryman. To quote a figure of 5 per cent. as a normal working practice was, in his opinion, misleading.

Dimensional Errors

MR. TEMPLETON wanted to know what was being meant when they referred to scrap, was it dimensionally or metallurgically? On the investment process they could argue dimensionally and not bring in metallurgical scrap. If that was the case could figures be supplied of castings or percentages of castings rejected for dimensional errors.

MR. TOMKINSON said he thought Mr. Paget had in mind dimensional accuracy. As he had remarked earlier, dimensions were controlled by the investment mixture and any slight deviation from the mixture set down by the chemist could give dimensional inaccuracy. Furthermore, casting temperatures could affect the tolerances and, again, the firing of the mould could affect them. He thought they could safely say that scrap due to dimensional inaccuracy could be kept as low as 2 per cent. When talking of scrap, they took an overall picture of X-ray, crack-testing and so on. A defect they were prone to get, and one which might raise the scrap figure, was inclusions in the investment which could break away from the mould when it was being poured.

Manufacture of the Die

MR. LEVY said he would be interested to hear whether the lecturers could tell them anything about prototype castings made with the investment process. How were they provided? It had been said that there were certain dimensional tolerances on the refractory that might come into the picture. Obviously that would affect the metal die for making the wax pattern. Therefore it did not seem sensible to him to produce, initially (if one was faced with a new casting) an expensive die with which to produce the wax pattern. That, too, would require a definite gating and running system. How would investment founders undertake this preliminary business?

MR. TOMKINSON said the least of the worries was the manufacture of the die. Normally, a soft metal die was used, and he thought they had got enough experience to enable them to make a model of the die to bring off an almost accurate replica of the

casting. He did not think either Mr. Paget or himself had had to scrap a die or a model because it was inaccurate. They had built up over the last few years sufficient experience to produce a model incorporating the shrinkage allowance of the wax and the expansion of the refractory so as to allow them to make a reasonably good prototype casting. However, they did need to experiment with gating and running. They therefore made a prototype set-up of wax and cast it to ascertain if their castings were sound. Having satisfied themselves that the gates and runners were in the correct positions, then they could proceed with production. If not, they made up a further set-up of waxes. That might happen three times, but they did succeed eventually.

MR. LEVY asked did they, in the initial stages, mould by hand their gating and running system.

MR. TOMKINSON said they did with the first ones and then they made up a die incorporating the gating.

MR. ANDREWS said it had been pointed out that a number of people in the investment casting business were essential, but no mention had been made of the die-maker and he felt that an investment foundry was useless without a good die-maker, whether it was at the soft metal stage or later.

MR. TOMKINSON said he had not mentioned the die-maker because his firm envisaged their dies and moulds in the planning department so that they could hand down to a die-maker complete details of the casting. Therefore they could now employ semi-skilled or practically unskilled labour—that was on the soft-metal dies, of course.

MR. ANDREWS said they employed semi-skilled labour, but they also felt that the bringing in of a man who had had years of experience in engineering industry on die-making was a useful asset. In fact, much experience from, say, zinc-base or aluminium die-casting methods could be utilized in the investment casting process.

MR. TOMKINSON agreed; his firm were using aluminium dies—steel-insert dies—but it remained the same. They planned to the highest possible degree because they had not the necessary experienced personnel, and they did not depend a great deal on the inexperienced operator.

Mould Details

MR. A. R. WIZARD said the subject was extremely interesting because in investment casting they were dealing with castings of a high degree of accuracy. In the matter of coring small castings how did they go about it, and how did they support the core, if one was incorporated? The spraying of the investment interested him very much; when spraying it over the wax pattern, how was the material kept fluid and what thinnings were used?

Another point he would like cleared up concerned the initial castings, or the initial design of the prototype metal moulds. He would have thought they could have followed an old custom of making up a test pattern with runners and risers attached and from that a gelatine mould into which they could make a few wax models and then continue with investment to test the efficiency of the runners and risers.

Mr. Tomkinson said they had tried such methods but dimensional accuracy played an important part. They could not, from plaster, get the same accuracy that they could from the silica investment. Obviously, they could not use very high-temperature metals in the plaster. He was talking of materials in the region of 1,600 deg. C.

MR. WIZARD fully understood that they were not going to cast metal into the plaster, but suggested they could make a gelatine mould from a plaster mould which would enable them to make a model of the gate and runner system which they could develop by trial and error, thereby they would have something already proved with which they could go to the tool-maker for the making of a permanent steel die.

MR. TOMKINSON said they had tried that, but they were still confronted with the necessity of casting metal and the runner which was obviously placed on the wax was not necessarily sufficient adequately to compensate for shrinkage in the metal. However, he believed Mr. Paget had adopted the method for various small components. Nevertheless, as he had pointed out, it was felt that they had built up sufficient experience to dispense with the making of trial models.

Cores were used and sometimes for very intricate shaps, but they did try and draw the line at blind holes, for the simple reason that anchorage at one end of the core only was not sufficient to stand up against the on-rush of the metal. It must not be forgotten that the high temperature, between 1,000 and 1,100 deg. C. to which the moulds were heated and at which the refractory was quite weak, the on-rush of the metal would break down straight cores quite easily. Cores were sometimes re-inforced with ceramic shapes, but they were costly and they advised customers, where possible, to drill holes rather than core them out. In any case, even the most accurate cored hole would need cleaning out if it was to be used as a running fit. There was, however, no reason why most castings should not receive a cored shape that the designer desired.

Application to Non-ferrous Casting

MR. ANDREWS asked could Mr. Tomkinson give any information regarding the use of investment casting on non-ferrous metals and alloys.

MR. TOMKINSON said they did a very limited amount of non-ferrous investment casting in alloys for special jobs for some of their favoured customers and they did use the same refractories as were used on steel. It was very dangerous to experiment with refractories to suit individual jobs although special ones could be made up quite cheaply for non-ferrous castings. These usually contained a certain amount of plaster, and there was then the risk of trouble, if they got it mixed up with steel investment materials. On certain components manufactured for the scientific-instrument trade, the sand foundry or the die-casting foundry could not compete with them in investment casting. They could turn out intricate castings at low cost—he could not divulge the actual cost—but he thought the die-casters would be hard put to it to compete with them.

Symposium on Investment Casting

Scrap Figures

MR. MCCLURE said he had cast several hundred of milling cutters during the past few years and they had always found them better than the forged cutters. He had always been led to believe that the secret of a good cutter was to break down the carbide network. He had had some dealings with Mr. Tomkinson's Company and they never got any inclusions in the castings. However, he would like some figure, if possible, about what percentage of scrap could be attributed to inclusions.

MR. TOMKINSON assured the audience that scrap at his foundry from inclusions was very low. He thought Mr. Crook, who had just left the company and was preparing one of the largest foundries to be built in the country, could probably give some figures.

MR. CROOK said if his memory served, out of a hundred turbine-blade castings which were the main item in the foundry while he was there, one could be put aside for hair-line cracks on a rigorous check test; two for dimensional inaccuracy (which might in any other field of foundrywork escape entirely as merely being one or two thousandths of an inch below or above the required tolerance); a further two for inclusions and the remaining scrap up to 10 out of 100 castings) was for minor defects to the wax pattern, distortion, or causes which varied from one casting to another which could not be classified as cracks or interior defects or inclusions.

Superiority of Cast Cutters

MR. LISTER, on the question of milling cutter life, said the cast cutter, if it was heat-treated correctly—and he emphasized that point—would give longer life than a forged cutter. Its structure was very similar to the grain flow of a casting, but was obviously different from that of a forged cutter and the grain size caused by the heat-treatment was different. They did not get the chatter with the cast cutter that was experienced with the forged article and the result was that not so many stresses were set up and the cutter was, in consequence, a stronger job.

MR. J. C. SWAN thought the real reason a better result was obtained from a cast cutter was due to the smaller particle size of the carbides in the much reduced section of the cast cutter as compared with, say, the 8-in. square section of an ingot from which after forging the cutter would be machined. The carbide structure in a large-section high-speed-steel ingot was very coarse even after hot mechanical working.

MR. S. B. MICHAEL suggested that, looking ahead to the time when producers of investment castings must turn to suitable general engineering requirements as a market, it might be as well—in view of present misconceptions— to start making widely known (including by the issue of pamphlets), the kind of application for which investment castings were and were not appropriate.

Mr. Hudson replied that for years past he and his colleagues had given numerous lectures all over Great Britain on that subject and he could supply many references to published literature giving all the information that Mr. Michael required. In view of what had already been done, and what literature was available, it did not seem worth-while issuing further publications at present.

Permeability of Moulds

MR. RHODES asked whether there was any permeability in the investment material when it was baked, and whether the gas was actually driven through it.

Mr. Tomkinson said yes, there was significant and measurable permeability in the moulds and he thought Mr. Crook could probably add some information on that point.

MR. CROOK said it was very difficult to measure permeability at the temperature at which the moulds were cast, but at room temperature the permeability was in the neighbourhood of 10. That sounded very small, but in his experience there had been no difficulty in driving gas and air through the mould material.

Wax

A MEMBER pointed out that no one had said very much about wax, except Mr. Crook who had mentioned that almost 50 per cent. of the rejects in casting were due to wax defects. He would like to know how much "lost" was the lost wax? Was there any material which they could use which was not lost in the process?

MR. TOMKINSON said they did not "lose" wax, simply because they recovered it. The amount lost by volatilization was about 8 to 10 per cent., but they recovered, refined and used again the other 90 per cent.

MR. BERRY wanted to know if the lecturers had had any experience of casting cobalt-base materials such as Stellite.

Mr. Tomkinson said the majority of the castings turned out in his foundry were cobalt-base materials. No special precautions were needed as they liked the material and preferred to work with it. Their furnacemen treated with respect cobalt-base materials; they cast at a very high temperature with little scrap and very often found that no special treatment was necessary. They melted their metal direct in a carbon-arc furnace without detriment.

MR. BERRY asked further if members could be told that sort of material was used for the refractory of that furnace.

MR. TOMKINSON said he thought the Austenal Patent for the carbon-arc furnace was widely known. They used sillimanite for investigational work, research and development and had also used a number of alumina-magnesia refractories. It was no use his giving dimensional shapes or design information because obviously they might not be able to operate the same way as he did. Many who had followed his practice had found themselves in trouble, but after slight modification and change in design with their own particular furnace they had overcome their difficulties.

MR. BERRY also wanted to know if the metals could be melted in a high-frequency furnace with the same facility

Mr. Tomkinson said that in a high-frequency furnace, they recovered their cobalt materials without any loss or detriment to the material, and their chief chemist gave a good report on all material melted in this furnace. There was no trouble at all in melting.

Quantity Production

THE CHAIRMAN, Mr. L. G. Beresford, said he had received an impression, probably from the film, that the process did not lend itself to quantity production, but he did not think that was true. He thought the process was capable of quantity production, as well as production to close dimensional accuracy.

MR. TOMKINSON said obviously his firm liked quantity production. Making moulds and dies could become costly if they were intricate, and they obviously wanted to make a large number of castings; the more they made the cheaper the process became. It was at one time thought the process lent itself only to small numbers of components, but most investment founders liked to manufacture as many as possible because they could then quote prices which were competitive.

He had refrained from quoting the old lost-wax process or the use of the dental casting methods because every previous Paper he had read talked about the Cellini process and the way the modern process had been built up from it. Frankly, he did not think there was any proper comparison at all possible.

Centrifugal Casting

The spinning or the centrifugal process was obviously very much used in the dental profession to-day. He liked to think that the process now was something growing up. In his plant they had a centrifugal casting machine and they could cast quite large components. As a matter of fact any large component, any intricate or very thin component they did centrifuge. They got much better properties and they could fling the metal into those very thin sections and bring out very much more homogeneous castings. He would cite one example—he had occasion to investment cast some rather large pipe-flanges and when welding on the pipes they cracked and caused trouble. He decided to use the foundryman's method of running these centrifugally and he had never seen better castings. They had not been able to crack one and those castings could be turned out to a remarkable degree of accuracy.

MR. A. R. PARKES asked could Mr. Tomkinson give them any comparisons between his process and the Shaw-Osborn method of producing investment castings?

MR. TOMKINSON said the Shaw-Osborn process was one of using a semi-permanent mould. A model was first made and the procedure was very much that of the original lost-wax method. A model having been made, sections of it were cast in plaster. These were replaced by Sillimanite drawbacks. When the model was extracted, the mould was built up and bound together. The binder was ethyl silicate and alcohol and a quick-drying and hardening of the investment was secured merely by igniting the alcohol. By careful planning and design of the mould parts, and by gently taking away the drawbacks, it was possible to get a number of castings without destroying the mould, providing there were no difficult angles which would break down. He believed the process was subject to a number of Patents.

Vote of Thanks

MR. WIZARD proposed a vote of thanks to Mr. Hudson and said he had been in sympathy with all that had been said up to the point where it was stated that there was no comparison possible with the methods of Cellini. Probably the only difference between the present problems and those of Cellini was that Cellini had no man in a white coat standing around! He had thoroughly enjoyed the meeting and he was sure the other members present had also.

MR. EVANS, who seconded the vote of thanks, remarked that he would make a few observations that he had hoped would have been made earlier. The lecture was excellent, but he disagreed with some of the suggestions made. The plea for the use of investment castings in general engineering was, he thought, a false one. "General engineering" implied that the castings would be in mild steel and other ordinary materials, but he felt that investment casting could never compete with machining in this field. The future for investment casting must be in those special alloys which were difficult to machine or hot-work, as in the work already done for the jet engine. The future of investment casting lay with the metallurgists. It was up to them now to bring out of cold storage a range of those alloys which could not hitherto be used because they could not be machined or hot-worked. If investment casting tried to compete in general engineering with machining methods it would fail, because such methods were gaining in efficiency every year and the process never could compete in accuracy, as had been admitted in the lecture. Notwithstanding this purely personal observation, Mr. Hudson and Mr. Tomkinson had given an excellent lecture, and he was sure all were grateful to them for it.

A PENSION SCHEME for male manual workers, estimated to cost £70,000 a year, has been introduced by Ruston & Hornsby, Limited, engineers, etc., of Lincoln.

First Electric Steel-melting Furnace.—A letter from the publicity manager of Edgar Allen & Company, Limited, of Sheffield, points out that in the golden jubilee issue we credited Lake & Elliot, of Braintree, as being the first to instal an electric steel melting furnace, whereas Edgar Allen & Company were really the pioneers, although their furnace was engaged on the production of steel for ingots. As the note was intended to refer to the steelfoundry industry, the original statement regarded from that angle is correct. We well recall that Edgar Allen's were the first to instal an electric furnace for ingot manufacture, and this statement clarifies the position.

Improved French Steel Output

The improvement in coke supplies in January, when the tonnage delivered was at the record figure of 1,397,000 metric tons, has had a favourable effect on iron and steel production in France and the Saar. Pig-iron production in France was 808,000 metric tons in March, against 752,000 metric tons in February. Saar pig-iron output in March was 215,000 metric tons, compared with 198,000 metric tons in the previous month.

Crude steel production in France was 933,000 metric tons in March (854,000 metric tons in February), that of the Saar being 240,000 metric tons (219,000 metric tons in February).

French production of rolled products was 677,000 metric tons in March, compared with 636,000 metric tons in February. Saar output of rolled products was 164,000 metric tons in March, against 155,000 metric tons in February.

Swedish Iron Market Problems

The Swedish iron market is threatened by difficulties arising out of the decision of the Price Control Board not to allow price increases in respect of pig-iron which the industry considers necessary in view of the current level of costs. Swedish ironworks have warned their customers that they are uncertain whether they can complete orders on hand, and that in any case considerable delays may ensue. The board's decision also affects the Norrbotten Iron Works, which has announced that it will produce more steel and use greater amounts of its own pig-iron than originally intended.

It is feared in industrial circles that Swedish foundries may be forced to buy French pig-iron at Kr.554 per ton, compared with the Kr.365 (£1=Kr.14.485) which has just been refused to the pig-iron producers by the Price Control Board.

Bridge Order for Germany

An order has been placed with a group of German firms for the construction of a bridge over the Euphrates, near Kufa, in Iraq. The bridge is to be a steel construction of seven spans with ramps to each bank. The contract has been entrusted to the Arbeitsgemeinschaft Philipp Holzmann AG, Frankfurt-am-Main, and the Dortmunder Brückenbau C. H. Jucho, Dortmund. The contract is valued at DM. 3,450,000.

This is the first large constructional work in Iraq which has not been entrusted to a British firm.

Iron Ore in Ceylon

According to a note in a report in the series of Oversea Economic Surveys issued by the Board of Trade and published by the Stationery Office (3s. 6d.), iron-ore deposits of fairly high grade, estimated to amount to approximately 6,000,000 tons, have been discovered in the south-west sector of the island and on analysis has been found to contain about 50 per cent. metallic iron. To produce it, only open-cast quarrying will be necessary and the authorities in Ceylon would consider the making of iron and steel if cheap electrical power could be made available.

THE MINISTRY OF MATERIALS has announced that from May 1 the price of imported good soft pig lead is decreased from £163 to £155 per ton, delivered consumers' works.

Sheffield University Metallurgists' Reunion

In post-war years, the research section of the metallurgy department, University of Sheffield, has held periodical reunion dinners, but never before has a reunion been organized for all "old boys" since the Department was set up some 63 years ago. The old metallurgical laboratories were built in 1880 as part of the engineering department, and it was not until 1889 that Prof. Arnold created a separate technical department. The first reunion dinner for old and present students was held in the University Union buildings on April 23, the attendance being 85. Mr. G. Baker, president of the Sheffield Society of Engineers and Metallurgists, who was present, received his Associateship in Metallurgy at Sheffield as long ago as 1899.

Prof. A. G. Quarrell, who occupied the chair, welcomed the guests, and expressed the disappointment felt by all present that Prof. Desch and Prof. Andrew could not be there due to ill-health. Among the guests were Mr. H. H. Burton (English Steel Corporation, Limited, and the Iron & Steel Institute Bessemer medallist this year); the registrar, Mr. A. W. Chapman; Mr. M. M. Hallett, of Sheepbridge Company, Limited, representing the Sheffield section of the Institute of Metals; Mr. J. Bycroft, bursar of the University, and Mr. G. Baker. Mr. Baker replied for the guests. Tribute was paid to Mr. E. J. Thackeray, who had been secretary of the Department for 48 years, and Dr. W. R. Maddocks for organizing the reunion. Among the old students present and not mentioned above were:—Dr. N. P. Allen (N.P.L.); Mr. L. K. Everitt (Edgar Allen & Company, Limited); Dr. J. W. Jenkin (Tube Investments, Limited), and Mr. S. S. Smith (Imperial Chemical Industries, Limited, Metals Division).

Industrial Safety Conference

For the sixth occasion in succession the National Industrial Safety Conference will take place this year at Scarborough. Organized by the industrial safety division of the Royal Society for the Prevention of Accidents, the conference will be held from May 16 to 18. A popular feature of these annual gatherings of industrial safety experts is the trade exhibition of industrial safety appliances which was first inaugurated three years ago. This year it has been redesigned on more elaborate grounds and will be expanded to occupy space in both the Royal and the Grand hotels.

Evidence of the importance attached to the conferences can be readily seen from the ever-increasing number of those attending each year. The programme this year includes Papers on accident prevention in the future by Dr. W. G. Hiscock, managing director of the Imperial Smelting Corporation, Limited; the safe handling of materials, by Mr. C. R. Wynne-Roberts, head of the production division of the British Institute of Management; training and lecture techniques, by Mr. R. N. LeFevre, training and education officer of the North Thames Gas Board; the relative responsibilities of contractor and occupier, by Mr. H. E. Phillips, safety officer of Vauxhall Motors, Limited; permit to work systems, by Mr. H. M. Page, refinery superintendent of National Oil Refineries, Limited; and a Paper on slippery floors, by Dr. F. C. Harper, of the Building Research Station.

Delegates will be welcomed by the Mayor of Scarborough, while the conference will be opened by Lord Llewellin, president of the Royal Society for the Prevention of Accidents.

Accident Prevention in Iron and Steel Works

By Sir George P. Barnett

(H.M. Chief Inspector of Factories)

The general problem of accidents in iron and steel works is a complex matter, depending mainly on two factors, environment and the human element. Accident causes and means of prevention by steel works engineers were analysed by Sir George Barnett recently at an Iron and Steel Engineers' Group symposium in London and extracts from this Paper are given below.

Frequency of Accidents

Iron and steel works give rise to something less than 10 per cent. of the total accidents reported annually to H.M. Inspectors of Factories, *i.e.*; accidents involving more than three days' absence from work. The general pattern of accident causation in iron and steel works shows certain pronounced variations from the pattern of accidents in factories generally. For example, the number of accidents due to machinery is only about slightly more than half as great proportionately, but in the case of accidents due to fires, gassing and burns the percentage is almost four times as great. The remaining discrepancies of any note are with respect to accidents due to hand tools and transport, for each of which the iron and steel works rate is half as great again as in all factories.

The approximate frequency of accidents due to the main causations expressed as a percentage of all accidents in iron and steel works is:—Machinery (9 per cent.), transport (6½ per cent.), electricity (1 per cent.), explosions (1 per cent.), fires, gassing and burns (6 per cent.), hand tools (13 per cent.), falling articles (10½ per cent.), persons falling (11 per cent.), stepping on or striking against objects (7 per cent.), handling articles (30 per cent.), and miscellaneous (5 per cent.). A noteworthy point is that iron and steel works account for close on a quarter of all accidents due to power-operated lifting machinery reported from all factories. As regards severity of accidents, whereas only one in every 360 accidents in factories as a whole is fatal, the rate for iron and steel works is one in 240.

As the list of causation shows, accidents in iron and steel works arise from the same causes as elsewhere, although with greater frequency in some cases than in others. The desired reduction can only be achieved by studying these causes in detail and taking counter measures not only to prevent a repetition, but also to avoid those which might occur if the dangers are not foreseen and preventive measures taken in time.

Physical Safeguards

The comparatively lesser number of accidents on machines means that there are fewer accidents now occurring which can be prevented by physical safeguards such as the fencing of dangerous machines. These must not, however, be neglected and there is plenty of scope for preventive action on such dangers as revolving shafting, gear wheels, couplings and pulleys and belts generally, crushing between work and the frames of certain types of machines, including scrap bundling machines. Then there are those other " machinery " accidents due not to danger inherent in the machine mechanism, but to danger created by the mobility of the machine. A most serious and common risk concerns the use of overhead travelling cranes giving rise to trapping of persons who may be on the gantry when the crane is in motion. Another somewhat similar risk arises from the movement of charging machines.

It is not only in respect of machinery that physical safeguards can be provided. Other risks can be obviated, for example, by the provision of safe working places and safe means of access thereto, firm and level floor surfaces for working upon, lifting machines and equipment of proper quality periodically overhauled and kept in good condition, properly maintained hand tools and appliances, good lighting, adequate ventilation, especially where inflammable or other dangerous gases are likely to be encountered, and effective protective clothing.

In tackling the many problems which arise when considering how accidents can be prevented, one must not be over-awed by what appear to be insurmountable physical difficulties. Most problems, however perplexing, have a solution. Do not be thwarted, for example, by the cramped conditions which obtain in many old works and do not overlook, in the layout of new works, the possibility of future extensions, as in the case of many existing works, where lack of foresight must be blamed for the present lack of space.

Lighting is of particular importance in iron and steel works. Round-the-clock working, the spaciousness of the works, considerable areas out of doors where work goes on and there is constant movement of men and vehicles, the high-intensity glare which furnacemen are exposed to—all these factors require general lighting of a very high order.

Means of Communication

Adequate and reliable means of communication between different parts of the works are of paramount importance. The various departments of iron and steel works are often dependent on a source of power or heat, *e.g.* steam, gas, etc., at a

considerable distance away in the same works. Such arrangements should take account of the fact that occasionally maintenance men work in isolated and dangerous positions. A recognized system should be followed rigidly when men have to work in such positions as gantries, furnace tops, gas etc. have to go to any part with which they are not mains, stove tops, etc. Where fitters, electricians, thoroughly conversant, they should invariably be accompanied by an experienced process man. Where work is being done in an area liable to be affected by gas, look-out men should be posted. Breathing and resuscitative equipment should be provided and men trained to use it.

Elevated platforms should be fenced with double rails and toeboards and means of access thereto should be by stairs fenced with double rails on each side. Walkways on bunker tops should be provided with guard rails. Trolley wires should be protected and conveyor belt mechanisms should be guarded.

Scrap yards should be large enough to admit of proper stacking and to enable burning, cutting, etc. to be done on the ground and not on top of piles of scrap. Floors should be level and firm and pathways should be properly constructed, clearly defined, and should leave adequate space between rakes of wagons. Plates in floors should be secured in position, as accidents have occurred due to loose plates becoming displaced and where such plates, as they frequently do, cover gearing, the risk of a person going through is not confined to falling but may give rise to a disastrous machinery accident. Scrap boxes should be properly designed and maintained and the bogies which carry them should be specially fitted so that boxes do not tip up or fall off. The layout should be such that men do not have to work or pass under magnet cranes.

Casting pit floors should be level and solid—constructed where possible of steel plates or other similar material. If the floor is uneven moulds may become unstable and be liable to fall over by contact with moulds swinging from the crane while being placed in position. In some works individual compartments have been built in which the moulds are placed so that they cannot fall.

Where furnace doors are fitted with balance weights, these should be totally enclosed over the full length of their movement. There should be adequate clearance between all railway lines and fixed structures and stacks of material. Where the lines carry hot castings or ladles clearance must be sufficient to allow men to pass the bogies in safety.

Guards and Fences

Where guards are provided, constant vigilance is necessary to see that they are replaced after repairs. Often the guards which are not replaced are those in positions to which someone goes only on occasion, under which circumstances a maintenance man, say, who has removed a guard to reach a particular part for the purpose of repair or oiling, may not replace it. Guards for the gearing, shafting, etc., on overhead travelling cranes are sometimes left off by reason of their comparative inaccessibility. This risk would not arise if the guard did not require to be removed for maintenance work and it is desirable that guards should be designed so that periodical maintenance work can be done with the guards in position.

Where it is not possible to provide secure fencing by fixed guards preventing access, a trip guard can often be used. This consists of a bar or some other form of obstruction with which a person approaching the point of danger is obliged to come into contact. When the bar is moved the drive is stopped and the dangerous part comes to rest. With such an arrangement there must not be sufficient lag after tripping the bar to enable the person to reach the dangerous part before the machine stops.

Maintenance men are commonly exposed to risk through lack of adequate precautions for their safety. When working on plant which is at rest someone may start it up unintentionally or without knowing that men are at work upon it. This risk can be avoided by adopting one or a combination of the following precautions:—(*a*) Withdrawal of fuses from circuits controlling the parts on which work is being done; (*b*) placing warning notices on switches; (*c*) written permit system; (*d*) logging of all switching operations, and (*e*) unified personal control.

Overhead Cranes

Reference has already been made to risk of persons being struck on overhead crane gantries. This risk does not only arise from the crane in the bay in which the person is working, but cranes in the adjacent bay may also be a source of danger. When a man is working on a crane track, he should be safeguarded from the risk of being struck by a crane on an adjacent track as well as by the crane on the track on which he is working. A crane may also be a danger to persons working remote from the track, but in a place near to where some part of the crane moves. For example, there may be a ladder upon which a man is working and which, if touched by the crane, may cause a man to fall. Then there is the case, say, of a window cleaner or of a man carrying out repairs near the roof who may be liable to be struck.

Risk of cranes being overloaded becomes more likely when the loads which have to be lifted cannot readily be ascertained. This is especially true of slag, the weight of which depends not only on the size of the lump but also on the metal content. An error in estimating such a load may result in overturning or collapse of a jib crane, which cannot fail to have the most serious personal and economic consequences. Where the weights to be handled by a crane cannot be readily ascertained with reasonable accuracy, the provision of an automatic safe load indicator is desirable.

The breaking up of old castings by dropping a tup from a jib crane has been the cause of many serious accidents, both to those engaged on the process who failed to take proper cover against the risk of flying fragments and to others at a distance who were unaware of the danger. Work of this kind should either be carried out in a pit lined with

concrete or other material or a deep shelter of steel plate or stout timbers should be erected around the place where such work is done. The ball or tup should not be released until the person in charge of the control rope is certain that no person is within the enclosure.

Explosion Risk.

The risk of explosion arises mainly about furnace plant.

The biggest risk of gas explosion is at starting and stopping gas-fired plant when gas in the mains and cleaning plant has to be replaced by air, or *vice versa*. The formation of a gas/air mixture must be avoided; to achieve this, the mains are purged with steam.

An explosion in the blast main can be disastrous—it is fortunately a rare occurrence in this country. It is caused by pressure going off the blast main; the blast air cools and contracts, sucking gas back from the furnace into the air main. When the blowers are restarted a gas and air mixture is blown forward and ignites at the furnace or a stove.

One or more of the following precautions are now standard practice:—

(i) A pressure of ·2 to 3 lb. per sq. in. is constantly maintained in the cold blast main by means of spare blowers standing by ready to be switched on in case of breakdown of a blower in use—sometimes all blowers and furnaces are cross connected, so that any blower may serve any furnace.

(ii) Suction of the furnace is avoided by:—(*a*) drop valves in ring main that open to atmosphere when the pressure falls to 2 to 3 lb. per sq. in.; (*b*) non-return valves in the mixing main to prevent the passage of gas, or valves that effect disconnection automatically when the pressure drops; (*c*) complete disconnection of blast pipes for prolonged stoppage.

Gassing risks are responsible for many serious accidents in iron and steel works. During the four years 1947 to 1950 inclusive, no fewer than 31 persons were killed and 170 injured as a result of being gassed. Of these 47 (8 fatalities) occurred at blast furnaces, 16 (1fatality) at gas producers and 107 (22 fatalities) in connection with the distribution and use of gas.

For entry into flues, mains, stills, gas-washing plant and similar confined spaces, only two courses are open:—(*a*) Full breathing apparatus must be worn. (*b*) Plant must be isolated; sludge removed from *outside*; plant ventilated; atmosphere tested and proved safe and an adequate supply of fresh air ensured.

Leakage, more or less continuous, occurs from brick-built plant such as regenerators, furnaces and billet stoves, particularly when plant is being lit up, either for the first time or after repairs. Constant attention is needed to keep leakage down to the minimum, and a high standard of ventilation must be maintained everywhere.

X-ray Hazards

In recent years, there has been a considerable expansion in the industrial use and in the power of X-rays for the radiography of castings and welds in iron and steel foundries; and the increasing availability from the Atomic Energy Research Establishment, Harwell, of suitable and inexpensive gamma-ray emitting radioactive isotopes has equally resulted in increased use, for similar purposes, being made of these artificial radioactive materials to supplement the use of radon and radium, the naturally occurring radioactive elements which have been in use for a much longer period.

X-ray sets of 250-400 kV. rating are almost normal equipment in most iron and steel works nowadays, and in special circumstances powerful sets up to 2,000 kV. have been installed. Correspondingly powerful sources of gamma radiation from cobalt 60, tantalum 182 and iridium 192 in strengths up to and around 1 curie (equivalen. to 1 gram of radium) are in daily use to supplement the sources of X-radiation.

It might have been expected that with such powerful sources of ionizing radiation in use under factory conditions there would have been a number of serious accidents. Experience, fortunately, has shown the opposite to be the case. Accidents have been extremely rare and the problems in this radiological field are much more related to health protection than to accident prevention.

Only three cases of X-ray burn have been reported to the Factory Department from iron and steel foundries. The cause was failure to provide all entrances to X-ray rooms with electrical interlocks and warning lights to ensure that the X-ray tubes within cannot be energized until all entrances are closed; the control panels being situated outside completely enclosed X-ray rooms whose walls (and ceilings and floors where necessary) are of full protective thickness.

No accidents have yet been reported from the use of powerful gamma-ray sources. This, perhaps, might have been expected, since X-ray tubes produce much more concentrated beams of radiation than gamma-ray sources.

Precautions against Rays

This good record has been achieved by the industry having paid careful attention to such matters as the correct construction and protection of X-ray rooms, shockproof X-ray tubes and associated equipment; exclusion, during radiographic exposures, of workers from X-ray rooms and from defined areas around gamma-ray sources; provision of interlocking arrangements and warning lights in the case of X-ray rooms; provision of adequately protected, and where necessary, ventilated safes or boreholes and of protective carriers for the storage and transport, respectively, of radioactive sources; use of remote control or automatic clockwork-controlled methods of removing radioactive sources from their carriers; testing of workers' radiation exposure by the use of personal film badges and by instrumental monitoring; skilled and competent supervision of the safety and health precautions; and routine clinical and hæmatological examination of workers concerned.

Imports and Exports of Iron and Steel in March

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in March. Figures for the same month in 1951 are given for the purposes of comparison and totals for the first three months of 1952 and of 1951 are also included.

Total Exports of Iron and Steel

Destination.	Month ended March 31.		Three months ended March 31.	
	1951.	1952.	1951.	1952.
	Tons.	Tons.	Tons.	Tons.
Channel Islands	671	594	1,979	1,767
Gobraltar	26	83	124	210
Malta and Gozo	130	100	642	508
Cyprus	172	247	1,226	90 6
Sierra Leone	174	527	629	1,360
Gold Coast	876	1,846	4,325	8,427
Nigeria	3,143	3,637	14,659	13,399
Union of South Africa	8,328	12,953	29,019	37,672
Northern Rhodesia	1,232	2,405	4,072	7,644
Southern Rhodesia	2,293	4,814	7,089	11,973
Tanganyika	848	1,936	4,858	6,391
Kenya	3,782	3,623	16,108	12,188
Uganda	183	698	1,341	2,470
Mauritius	488	243	1,459	1,106
Bahrein, Qatar, and Trucial Oman	893	2,231	2,401	4,388
Kuwait		1,838		5,773
India	5,523	5,184	24,503	15,920
Pakistan	11,146	7,795	22,858	18,248
Malaya	4,483	5,323	17,480	19,356
Ceylon	2,339	2,098	7,307	5,653
North Borneo	431	287	765	891
Hongkong	2,718	1,020	18,032	3,804
Australia	18,553	36,575	95,692	94,672
New Zealand	8,537	7,863	34,231	32,891
Canada	20,311	16,352	48,581	43,492
Jamaica	808	2,820	3,396	7,197
Trinidad	2,296	3,648	6,737	12,881
British Guiana	367	309	1,330	1,176
Anglo-Egyptian Sudan	733	1,055	2,277	3,464
Other Commonwealth	1,574	1,940	5,195	7,491
Irish Republic	8,280	6,477	22,248	17,188
Soviet Union	548	—	1,485	1
Finland	3,622	6,854	10,903	18,272
Sweden	7,388	9,451	23,704	28,087
Norway	5,068	6,404	16,141	16,151
Iceland	112	102	603	409
Denmark	6,684	9,247	24,621	26,247
Poland	155	—	375	32
Germany	118	78	346	401
Netherlands	8,773	10,136	22,331	23,254
Belgium	1,361	849	3,767	2,205
France	689	172	3,090	732
Switzerland	925	769	3,083	2,187
Portugal	2,453	910	4,813	2,556
Spain	444	418	891	1,055
Italy	2,309	425	3,990	4,878
Austria	30	25	136	128
Yugoslavia	148	1,014	2,168	2,282
Greece	80	149	746	1,160
Turkey	268	1,080	837	2,285
Netherlands Antilles	299	1,022	844	3,672
Belgian Congo	184	407	478	868
Angola	79	237	650	1,829
Portuguese E. Africa	270	156	865	959
Canary Islands	202	124	329	363
Syria	78	272	475	544
Lebanon	1,931	2,109	3,097	4,226
Israel	2,521	1,090	6,758	4,531
Egypt	2,654	1,554	9,787	9,286
Morocco	16	25	1,238	89
Saudi Arabia	8	727	77	1,640
Iraq	1,944	2,259	6,630	12,310
Iran	9,838	1,116	21,801	3,425
Burma	1,279	659	3,616	3,196
Thailand	1,887	678	4,302	2,179
Indonesia	443	1,920	1,658	3,655
China	1,283	—	3,430	—
Philippine Republic	286	320	1,201	1,378
U.S.A.	20,963	1,989	54,202	14,498
Cuba	628	140	1,349	608
Colombia	1,067	885	2,500	1,705
Venezuela	1,811	6,362	6,970	14,196
Ecuador	107	478	238	1,404
Peru	820	1,340	2,625	2,764
Chile	1,267	211	2,915	959
Brazil	2,395	1,936	6,143	4,878
Uruguay	365	729	5,204	1,772
Argentina	3,224	3,095	12,926	9,619
Other foreign	1,229	1,919	5,126	5,212
TOTAL	211,591	218,368	692,027	644,593

Total Imports of Iron and Steel

From	Month ended March 31.		Three months ended March 31.	
	1951.	1952.	1951.	1952.
	Tons.	Tons.	Tons.	Tons.
India	—	—	1	44
Canada	3,622	6,202	11,883	14,236
Other Commonwealth countries and the Irish Republic	144	240	349	1,187
Sweden	1,873	2,963	4,818	7,349
Norway	3,923	7,213	11,010	17,175
Germany	1,320	9,038	3,587	24,283
Netherlands	6,125	12,901	12,718	34,373
Belgium	8,462	22,617	28,363	67,960
Luxembourg	6,222	12,944	21,728	39,018
France	19,010	21,866	64,824	70,446
Austria	33	5	71	20,151
U.S.A.	3,837	34,125	10,426	62,705
Other foreign countries	65	14,863	484	30,650
TOTAL	54,636	144,977	170,262	389,577
Iron and steel scrap and waste, fit only for the recovery of metal	51,852	28,833	193,417	114,651

Exports of Iron and Steel by Products

Product.	Month ended March 31.		Three months ended March 31.	
	1951.	1952.	1951.	1952.
	Tons.	Tons.	Tons.	Tons.
Pig-iron	1,286	308	7,634	941
Ferro-tungsten	36	21	193	49
Other ferro-alloys	333	675	885	1,110
Ingots, blooms, billets, and slabs	1,309	2	2,933	75
Iron bars and rods	921	241	2,313	919
Sheet and tinplate bars and wire rods	1,852	76	4,402	455
Bright steel bars	2,919	1,189	12,327	3,493
Alloy steel bars and rods	1,218	1,164	4,023	3,773
Other steel bars and rods	16,675	9,173	61,613	29,289
Angles, shapes, and sections	13,642	13,498	51,101	35,998
Castings and forgings	781	1,169	2,511	3,295
Girders, beams, joists, and pillars (rolled)	2,788	3,184	10,313	9,652
Hoop and strip	7,059	4,540	18,241	13,203
Iron plates and sheets	265	44	513	102
Tinplate	18,551	24,781	64,383	71,054
Tinned sheets	211	75	687	331
Ternplates and decorated tinplates	169	98	370	230
Other steel plate (¼ in. thick and over)	24,738	21,553	72,214	68,882
Galvanized sheets	3,302	5,259	17,106	16,130
Black sheets	10,073	10,945	34,414	34,683
Other coated plates and sheets	511	1,316	2,080	2,876
Cast-iron pipes up to 6 in. dia.	5,579	7,469	16,029	23,133
Do., over 6 in. dia.	5,847	5,830	15,370	16,163
Wrought-iron tubes	30,037	35,751	86,393	111,818
Railway material	17,083	18,519	56,772	51,354
Wire	4,536	4,687	17,030	14,100
Cable and rope	2,375	2,427	7,271	7,251
Wire nails, etc.	2,685	926	7,144	3,048
Other nails, tacks, etc.	254	429	964	1,332
Rivets and washers	397	595	1,616	1,601
Wood screws	241	391	962	1,105
Bolts, nuts, and metal screws	2,125	2,050	6,758	6,886
Baths	1,053	1,783	3,288	5,229
Anchors, etc.	830	620	2,135	2,668
Chains, etc.	869	916	2,470	2,781
Springs	425	478	1,522	1,523
Holloware	4,477	3,228	11,322	10,360
Doors and windows	1,567	1,748	4,253	5,504
TOTAL, including other manufactures not listed above	211,591	218,368	692,027	644,593

Personal

MR. W. WILSON has been elected president of the Southall (Middlesex) Chamber of Commerce in their golden jubilee year.

EMPLOYEES and staff made a presentation to MR. H. DAVIES, managing director of Darrold Engineering Company, Limited, Blackheath (Staffs), at the company's annual dinner and dance last week.

WILLIAM HAMILTON & COMPANY, LIMITED, Greenock shipbuilders, have appointed MR. HORACE WILLSON chairman of the board in succession to the late Sir James Lithgow, Bt. He will continue to act as managing director of the firm.

KEITH BLACKMAN, LIMITED, Mill Mead Road, Tottenham, London, N.17, are transferring MR. J. G. EMINTON formerly of the London Head Office to Bristol. His address will be 13, West Dene, Westbury-on-Trym, Bristol, Glos. (Telephone No.: Stoke Bishop 82519).

MR. H. W. BOSWORTH, chairman of Lancashire Dynamo Holdings, Limited, and Lancashire Dynamo & Crypto (Mfg.), Limited, has recently returned from a six months' business tour of Australia and New Zealand. On his outward voyage he also visited Ceylon.

MR. C. W. GLANISTER, who has been appointed resident representative of the Brush Aboe group of companies, in British West Africa, left last week to take up his new post. The territories he will cover are Nigeria, the British Cameroons, the Gold Coast, Sierra Leone, and Gambia. He was formerly the group's export manager in London.

PROF. FRANK CHARLES THOMPSON, Professor of Metallurgy in Manchester University, will lecture for the British Council in Austria this month. He will lecture in German at the Teknische Hochschule, Graz; the Montanistische Hochschule, Leoben; and to the Chemisch-Physikalische Gesellschaft, and the Ingenieur-u. Architekten-Verein, in Vienna.

A FORMER HEAD of the chemical and metallurgical department of the Wolverhampton and South Staffordshire Technical College, MR. W. REGAN, was recently elected president of the Staffordshire Iron and Steel Institute, the oldest body of its kind in the country, for 1952-53. Mr. Regan is now assistant chief education officer to Richard, Thomas & Balwins, Limited.

MR. W. W. STEVENSON, chief metallurgist of Dorman Long & Company, Limited, Middlesbrough, is president of the newly-formed North-East Metallurgy Society, MR. F. H. KEATING, chief metallurgist of Imperial Chemical Industries, Limited, Billingham, and MR. J. W. GAILER, of Constantine Technical College, have been appointed vice-presidents. Mr. Gailer is also secretary and treasurer.

Obituary

MR. F. L. MARRIAN, formerly sales manager of the British Oxygen Company, Limited, in Yorkshire and Lincolnshire, has died. He was 72.

MR. WILLIAM DALLOW, a director of British Timken, Limited, tapered rolling bearing manufacturers, of Birmingham, for many years until his retirement in 1939, has died at the age of 74.

THE DEATH has occurred at the age of 80 of MR. FRANK PIERCY, who, until his retirement a few years ago, was assistant to the general manager of the Wallsend Slipway & Engineering Company, Limited.

Lloyd's Shipbuilding Returns

March Quarter, 1952

Lloyd's Register shipbuilding returns relating to merchant ships of 100 tons gross and upwards, for the quarter ended March, 1952 show that in Great Britain and Northern Ireland at that date, steamships and motorships under construction totalled 356 ships of 2,270,621 tons gross, an increase of 61,609 tons compared with the previous quarter. It includes 121 steamers of 955,327 tons and 234 motorships of 314,644 tons. In the remainder of the Commonwealth, 51 ships of 166,022 tons were under construction compared with 37 ships of 148,354 tons in the December quarter, these vessels including 20 steamers of 134,076 tons and 16 motorships of 31,276 tons. Oil tankers of 1,000 tons and upwards building in Great Britain and Northern Ireland totalled 109 ships of 1,285,060 tons, an increase of 45,563 tons compared with the previous quarter. This is the highest tanker tonnage ever reported for this country, as also is the oil tanker percentage of the total under construction in all countries, this being 56.6 per cent. World figures of ships being built totalled 312 steamers of 2,330,018 tons and 904 motorships of 3,348,820 tons, making a total of 1,224 ships of 5,680,568 tons compared with 1,212 ships of 5,494,065 tons in the December quarter of last year.

Ships under construction in the principal districts in Great Britain and Northern Ireland are shown in Table I.

TABLE I.—*Ships under Construction in the Principal Districts of Great Britain and Northern Ireland.*

District.	March 31, 1952.		December 31, 1951.		March 31, 1951.	
	No.	Gross tonnage.	No.	Gross tonnage.	No.	Gross tonnage.
Aberdeen ..	15	20,291	15	13,641	13	7,239
Barrow ..	6	114,750	6	114,150	5	96,750
Belfast ..	21	227,390	20	203,820	20	219,050
Bristol ..	5	1,950	3	860	3	920
Glasgow ..	84	586,859	90	574,760	78	503,441
Greenock ..	30	234,670	27	209,750	29	228,520
Dundee ..	7	49,317	7	45,017	10	54,245
Hartlepool ..	9	53,150	9	53,170	10	57,930
Hull	37	14,816	36	14,583	34	16,692
Leith	15	35,882	15	26,606	15	28,538
Liverpool ..	16	116,938	18	129,383	11	99,790
Middlesbrough	17	172,602	17	168,998	17	148,299
Newcastle-on-Tyne ..	45	432,281	44	442,597	36	372,856
Southampton ..	9	7,828	10	11,478	12	7,568
Sunderland ..	29	198,260	29	196,332	33	227,097

The sizes of steamers and motorships under construction in Great Britain and Northern Ireland included the following: Under 1,000 tons, 50 steam (58 motor) 1,000 to 1,999 tons, 4 steam (11); 2,000 to 3,999 tons, 9 steam (13); 4,000 to 5,999 tons, 9 steam (14); 6,000 to 7,999 tons, 13 steam (23); 8,000 to 9,999 tons, 6 steam (36); 10,000 to 14,999 tons, 11 steam (41); 15,000 to 19,999 tons, 12 steam (16); 20,000 to 24,999 tons, 2 steam (1); 25,000 to 29,999 tons, 1 steam (nil).

BRITISH RAILWAYS have placed a contract with the English Electric Company, Limited, for the diesel and electrical equipment for thirty-one 350-h.p. 0-6-0 type diesel-electric shunting locomotives to be built in 1953.

CHEMICAL ENGINEERING was referred to as the "fourth primary technology" by Sir Harold Hartley, F.R.S., the retiring president, when he addressed the annual corporate meeting of the Institution of Chemical Engineers in London last week. Chemical engineers, he said, would play their part in promoting national welfare.

News in Brief

THE OFFICES of *Revue de Métallurgie* have been changed to 25, rue de Clichy, Paris (IX).

PRODUCTION OF ALUMINIUM in Italy reached the record figure of 49,355 tons in 1951. The 1938 output was 25,925 tons.

THE ANNUAL GENERAL MEETING of the Netherlands Foundrymen's Association was held in the offices of N.V. "Industry" at Vaansen on May 7.

A PLANT for the assembly of railway wheels and axles being built by the English Steel Corporation, Limited, in South Africa, is expected to be ready in a few months.

INVESTIGATIONS into the possibility of establishing an iron and steel industry in the Lusaka area of Northern Rhodesia are being carried out by a United Kingdom firm of consulting engineers.

THE SOUTH WALES OFFICES of Cox & Danks, Limited, iron and steel scrap producers, etc., have been moved to Portfield House, Adelaide Street, Cardiff (telephone: Cardiff 21441).

"SOLIDIFICATION OF METALS" is the title of a lecture to be given on May 12, at 7.30 p.m. to the Sheffield local section of the Institute of Metals, University Building, St. George's Square, Sheffield.

FOUR cast-iron gas purifiers with a capacity of 3,000,000 cub. ft. are under construction for the Kilmarnock Gas Works at the Thorncliffe works, Sheffield, of Newton Chambers & Company, Limited.

THE BRITISH IRONFOUNDERS' ASSOCIATION of 145, St. Vincent Street, Glasgow, C.2, have issued "New Standard Price Lists for Rainwater and Soil Goods," Series No. 3200, which became operative on May 1.

PLANS ARE BEING MADE to form a branch of the Institution of Works Managers at Newcastle-upon-Tyne. Mr. John W. Nicholls, general secretary of the institution, has visited Newcastle to assist in making arrangements.

BUCKLEY & TAYLOR LIMITED have had plans approved to carry out foundry extensions at Castle Ironworks, Wrigley Street, Oldham. Actually, it is not a new scheme which has been commenced, but one held in abeyance for some time.

FROM THE FRENCH PRESS we learn that Mr. Roger Waeles—the president of the *Association Technique de Fonderie* has been made an Officer of the *Légion d'Honneur*. A second well-known French foundry to receive this honour is Mr. Léon Montupet.

UNITED KINGDOM ANTIMONY PRICES were lowered as from April 28 by £35 a ton—the 99.6 per cent. grade metal to £317 10s. and the 99 per cent. metal to £305. This followed a decline in the New York price on Saturday, from 50 cents to 44 cents per lb.

THE FILMS made by Mr. Edward Cook of the "Big Six" Film Unit covering the manufacturing processes of F. W. Lloyd & Company, Limited, Lloyds (Burton), Limited, and the Ruston Bucyrus digger received the major award at the recent commercial film congress in Milan.

THIRTY SHEFFIELD SCHOOLMASTERS recently attended a course of lectures on steelmaking organized jointly by the area training committee of the British Iron and Steel Federation and the Sheffield Education Committee. The lectures were given by forge and rolling-mill managers.

THE Catalogue of Productivity Reports issued by the Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1, lists for sale amongst nearly 30 others the Reports of the Grey iron and brassfoundry teams at 3s. 6d. and 7s. 6d. respectively, but the steel-founders' Report is out of print.

A PARTY of some 20 directors of members of the Gauge and Tool Makers' Association, accompanied by the association's secretary, flew to Hanover recently to visit the heavy industries section of the Hanover Fair, at which only German manufacturers and exporters are exhibiting.

THE AWARD for the best industrial sponsored film in Canada in 1951 has gone to "Package Power," a 32-minute, 16-mm. colour sound film, produced by Crawley Films Limited of Ottawa for Aluminium Limited, Montreal. The award was made by the Canadian Film Awards Committee.

WORK STARTED seven months ago on two extensions to dry docks owned by Middle Docks & Engineering Company, Limited, South Shields, will be completed early next year according to schedule. One dock is being extended by 25 ft. and the other by 71 ft. The work involves the removal of about 50,000 tons of earth and rock.

A CONTRACT for an 80,000-kva. auto-transformer for the Folsom hydro-electric plant on the Central Valley project in California has been secured by the English Electric Company, Limited. The Company's bid of $302,912 was the lowest of five applications, and was the only one promising delivery within the time specified—two years.

THE *Centre Technique des Industries de la Fonderie* announces the opening by Mr. Pierre Richard, the president, of the tenth regional control laboratory at Rouen. In the basement of the laboratory there is an acid storage area which incorporates a system whereby the breakage of a carboy is rendered innocuous by the automatic draining of the fluid into a sump of calcium carbonate.

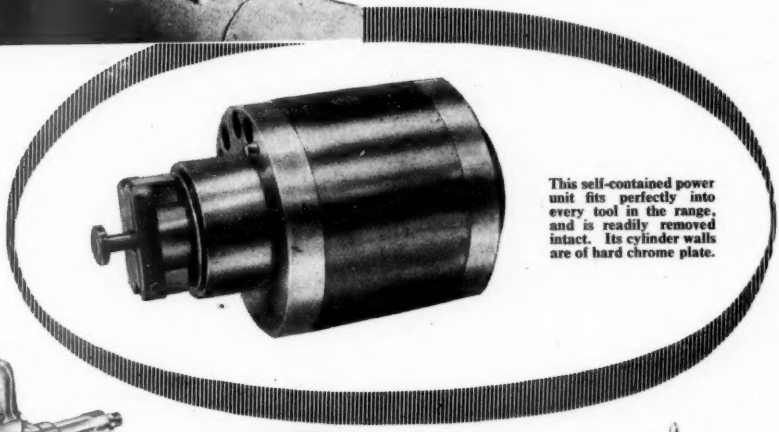
LITHGOWS, LIMITED, of Port Glasgow, have received an order for two dry cargo ships for the Anchor Line. This brings the total Anchor Line vessels under construction up to four. New ships will be of approximately 5,680 tons gross, with a dw. capacity of 9,450 tons. Overall length will be about 448 ft., and service speed 12 knots. Engines will be supplied by David Rowan & Company, Glasgow, of the Doxford Diesel type.

AT THE ANNUAL MEETING of the Derby Society of Engineers, Mr. Charles Carmichael, who has been associated with the Society for over 30 yrs., as secretary and treasurer, was presented on his retirement with a combined radio and television set. The presentation was made by the Mayor of Derby (Councillor Grayson). Mr. Carmichael has been a mechanical engineer for 57 yrs. The following officials were appointed at the meeting, as *chief patron*, Mr. F. D. Ley; as *president*, Mr. A. C. Jennings; as *vice-president*, Mr. O. H. Barker; and as *secretary and treasurer*, Mr. L. M. McDonald.

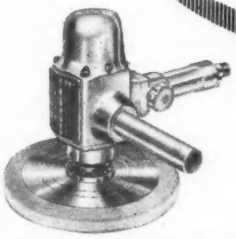
SIR EDWARD BOYLE, M.P. for Handsworth, Birmingham, is to ask in the House of Commons about the possibility of exporting aluminium from the United Kingdom. The enquiry is of considerable interest to several Midland firms dealing in non-ferrous metals. Sir Edward has already asked the Secretary of Overseas Trade (Mr. Henry Hopkinson) on April 28, if he would make a statement on the present supplies of aluminium. The reply received was, "Aluminium continues to be scarce throughout the world. While requirements in the United Kingdom cannot be met in full, contracts for supply from Canada, with home production, should make it possible to meet all defence and essential civilian needs."

"THESE HOLMAN *Interchangeable* MOTORS KEEP THINGS MOVING"

Completely self-contained, *interchangeable* motors make Holman Rotodrills and Rotogrinds exceptionally convenient and efficient in operation as well as unusually low in maintenance costs. Their power-weight ratio is appreciably higher than any other tools of equal capacity, and every tool in the range is a smooth-running well-balanced machine with all the dependability associated with Holman Pneumatic Tools.

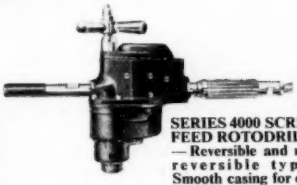


This self-contained power unit fits perfectly into every tool in the range, and is readily removed intact. Its cylinder walls are of hard chrome plate.



SERIES 41 ROTOSANDERS— Surface grinders and sanders ideal for large area work. Same interchangeable motor as in Series 4000 Rotodrills. Thumb-type throttle gives perfect control.

SERIES 40 ROTOGRINDS — Useful range of general-purpose grinders, surface grinders, loco rod and extension grinders. Various speeds for all classes of work. Straight or grip handles supplied. Features similar to Series 4000 Rotodrills.



SERIES 4000 SCREW FEED ROTODRILLS — Reversible and non-reversible types. Smooth casing for easy handling. Automatic safety device and lubrication. Instantaneous reversing — wide gearing range. All usual capacities available.

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SUBSIDIARY COMPANIES, BRANCHES AND AGENCIES THROUGHOUT THE WORLD. HC10

Raw Material Markets

Iron and Steel

Failing any appreciable increase in the supplies of scrap to the steelworks, restoration of ingot production to the peak levels of 1950 is almost wholly dependent on the provision of more hot metal to take the place of scrap in the furnace mixtures. Nor is an adjustment of this character necessarily a temporary expedient; the use of more pig-iron and less scrap in the open-hearth furnaces may be a permanent change. Shortages in the supply of pig-iron impose a check on the output of foundry castings; hence, the intense interest which is focused upon the efforts now in hand to increase blast-furnace production. Most of the planned expansion will comprise basic iron, but there is also a great and obvious need for an expansion of the supply of all grades of foundry iron. Few of the foundries are getting all the iron they need, but the scarcity of low- and medium-phosphorus grades seems to be most pronounced.

There is an enormous demand for all re-rolled products, and nothing comparable to the present demand for sheets has ever been known in the history of the trade. In no other branch of the steel trade is so large a proportion of the output required for rearmament, and the consequence is that requirements for other purposes receive scant attention. Scarcity of zinc also tends to restrict the proportion of sheets which can be galvanized, while the continued shortage of billets is causing irregularities in the operation of the mills engaged on light sections, small bars, etc.

Although the recent trend of events has been in the direction of a multiplication of the restrictions upon world trade, no serious apprehensions are entertained concerning the capacity of oversea markets to absorb all the steel which British makers are able to supply for export. It is believed that the restrictions upon shipments to Australia and New Zealand will be only of a temporary character, as both Dominions are in great need of increased tonnages. In any case, there are alternative outlets and British prices still compare favourably with those of the other big producing countries. Nor are the requirements of important home industries within measurable distance of being satisfied. Even the railways, collieries, and shipbuilders are rationed and outputs are eagerly absorbed immediately they are available for distribution.

Non-ferrous Metals

Two reductions in the lead price, each of £8, in one week is pretty drastic, but this is what happened during the first three days of May, and as we write, the current quotation is £147 per ton. This rapid alteration came as a result of events in the United States where the American Smelting & Refining Company initiated first a cut of one cent to 18 cents and followed it up by a further reduction of one cent to 17 cents. This is equal to £136 per ton, so that the British consumer is still paying £11 per ton more than his opposite number in America.

Following these startling adjustments in the virgin lead price, secondary metal and scrap have been marked down in line, but there is no report of any rush to buy. Probably users will continue to hold off until this market shows some sign of recovery, and then there may be a bit of a rush, for fabricators have certainly been drawing on stocks and allowing their holding to run down. But as things look at the moment there is little or no sign of the American market taking a turn for the better.

It now remains to be seen whether a fall will occur in the zinc price. Statistically zinc is in a sounder position than lead, but nevertheless there is nothing like the squeeze there was. An additional 2,000 metric tons of zinc have been allotted under the I.M.C. scheme to the U.K. for the second quarter, but actually it appears that we already have all the zinc we can absorb.

The situation in scrap seems to be, if anything, slightly better than it was, but secondary material is, of course, still very scarce, especially copper. But the evidence afforded by the fall in lead values that the non-ferrous price structure is beginning to crumble is likely to persuade holders of scrap that they ought to consider parting with some of their metal at any rate, and from now on we may well see an improvement.

Lead scrap had, of course, suffered a serious decline in value before the break came in the virgin price, but it will no doubt go lower. Business in tin last week was moderate, but the turnover is still a long way below the pre-war level when active conditions obtained on the London market.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £964 5s. to £964 15s.; Friday, £963 to £964; Monday, £964 10s. to £965; Tuesday, £964 to £964 10s.

Three Months—Thursday, £965 5s. to £965 15s.; Friday, £963 10s. to £964; Monday, £964 to £964 10s.; Tuesday, £963 10s. to £963 15s.

Mechanical Handling Exhibition

Olympia, London, June 4 to 14

At the third Mechanical Handling Exhibition and Convention to be held at Olympia, London, from June 4 to 14, 1952, items of interest to foundrymen will include:—

Portable short conveyors; pedestrian-controlled dumping trucks for movement of materials about the foundry; pallets and trolleys for handling components; overhead cranes, hoists and conveyors of many different types; various types of lifting magnets and magnetic separators, and appliances for lifting and moving awkward articles. Also to be shown is a full-size working skip-hoist of the semi-automatic type, in which the skip, on pressing a control button, moves to its tipping position and automatically returns for refilling. Other features will be a sand-handling unit for use in conjunction with moulding machines in foundries; a skip-hoist for elevating and delivering bulk materials to a range of bunkers; and a portable lifting gantry complete with electric hoist, and grips and tongs. In addition there will be a full-size wagon tippler, many types of mould-conveyors, a new form of variable-speed-control for electric hoists, an actual 10-ton, 3-motor, heavy duty cage-controlled overhead crane and radio-controlled gear for cranes.

Inspector of Ironfoundries

The Ministry of Supply has for some time had under consideration the appointment of inspectors to visit steel works and iron foundries to ensure that the Ministry's licensing arrangements are being operated correctly, and Mr. G. McMinn has now been appointed to visit iron foundries. He is attached to the Iron and Steel Division of the Ministry. He took up his duties on March 24 and has already visited a number of foundries. The Ministry trusts that Mr. McMinn's rôle will be largely advisory and that ironfounders will co-operate with him so that the present licensing machinery can be operated effectively.